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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

APRIL 19.

Institution of Welding Engineers:—Annual general meeting in London. Discussion of "Metallic Arc Welding."

Institute of British Foundrymen.

APRIL 15.

Sheffield and District Branch:—Annual general meeting. "The Spun-Pipe Plant at Staveley Coal & Iron Company," Paper by J. B. Allan.

APRIL 16.

Lancashire Branch (Junior Section):—Annual general meeting at Manchester. "The Merits of Oil-Bonded Cores," Paper by A. L. Key.

APRIL 23.

Newcastle-upon-Tyne and District Branch:—Annual general meeting, and general discussion on Foundry Problems.

APRIL 30.

Newcastle-upon-Tyne and District Branch (Junior Section):—Annual general meeting, and general discussion.

West Riding of Yorkshire Branch:—Annual general meeting at Bradford.

MAY 12.

London Branch:—Annual general meeting. "Crucible Melting Furnaces," Paper by G. L. Cassidy.

A Discussion on Testing Castings.

Dr. Rosenhain's Paper on the testing of castings, given in our issue of March 10, evoked a lively discussion, as will be seen from the report in our issue of March 31. The first point at issue was a certain confusion between inspection and testing, raising the question of the soundness of a casting. We think most founders and metallurgists will agree that the test-bar is not, and in the nature of things cannot be, any guide to the soundness of a casting, which must rely on founding skill and knowledge. We have always felt that the desire to take a test-piece from the casting itself has its origin in this desire to use the test-piece as a measure of soundness. Unfortunately, if the test-piece is sound, either one taken from the casting or separately cast, it does not follow that the casting is sound, although the inference may in most cases be justified. Conversely, if the test-bar is unsound it does not follow that the casting is unsound, and specifications usually recognise this. Similarly, if a piece cut from a casting is sound or unsound, it does not follow that the rest of the casting is equally sound or unsound. The question of soundness must be left to be dealt with in another way, and there is no better way of dealing with it than by putting confidence in a skilful foundryman who knows his job.

Generally, the separately-cast test-bar received support, and, where the cast-on bar was preferred, it was because of the inability of the inspector to see the metal poured and hence to be sure that a separately-cast bar would be of the same metal. There is, however, every reason to trust the honesty and straightforwardness of the foundryman, which also received tribute in the discussion. The only occasion on which he is tempted to be otherwise is when the engineer or buyer demands impossibilities. In case of doubt or error, an analysis of selected elements in the test-bar and casting would establish beyond question whether a cast-off bar was related to a particular casting or not. Any difference in properties between the two would be immediately shown by a difference in composition. The necessity for such a check would arise only very seldom, so that the cost would not be serious.

Altogether, the discussion was a useful one, and we shall revert to the matter when the full discussion is published, including contributions which for various reasons could not be presented at the meeting itself.

The Failure of Junior Sections.

We have recently given very serious thought to the question of organising Junior Sections in connection with societies of the type of the Institute of British Foundrymen. It must be confessed that in general they are a dismal failure. We have sought to find a remedy and only one possible solution is forthcoming. Amongst efforts that have proved futile we would cite the following:—It is useless to pay travelling expenses, tea money or provide similar inducements; the awarding of prizes, diplomas and medals is no incentive; the elimination of classroom conditions does not help. The only useful factor that we have been able to discover is the continual personal support of the senior members, together with an enthusiastic and experienced adult chairman. These conditions have obtained in the Lancashire area since the inception of the Junior Section of the local Branch of the Institute of British Foundrymen there, and it is the only one that possesses any real strength. A factor to be remembered is that quite often the attendance at a Junior Section interferes with the legitimate work of the evening classes. One of the reasons for the creation of Junior Sections is to feed the supporting parent body, but no great success can be definitely ascribed to this premise. The industrialist is somewhat alarmed as to the future shortage of skilled men, foremen and managers, but we feel that, as in the past, conditions will find the men. If the foundry industry does its best to provide and support evening classes for its apprentices; maintains its representative technical and research institutions in adequate measure, then, with all the millions of pounds lavished on general and technical education, there should be produced an ample reserve of people capable of carrying on successfully even so complicated an industry as is theirs. If the district associations still desire to conduct Junior Sections, then their members must be prepared to be personally present at every meeting to support the youngsters. No money inducements can or will supersede personal devotion to the interests of the younger entrants to the industry.

XUM

The Slump in Tin.

By "Onlooker."

In common with the other metals, tin opened this year with a show of promise and quite a good deal of optimism to encourage a belief in higher prices, a state of affairs which developed along favourable lines until comparatively recently, for it is not so many weeks ago that tin stood at £145 per ton and looked like going higher. The strength of tin was, however, more apparent than real, for a persistently poor demand was militating against any improvement in the statistical position and nullifying the efforts of the Tin Committee in their restriction scheme. This plan is whole-hearted, and but for the slump in consumption in America would have proved thoroughly effective, but as things have fallen out the total visible supplies have increased by some 9,000 tons in twelve months, the present figure being about 61,000 tons, while there are plenty of people holding the view that this total is understated.

Three main factors in the tin situation to-day are the International Tin Committee, the Tin Pool and the big band of speculators who are capable at any given time of upsetting the applecart. At their meeting last month the Committee put forward a suggestion that additional curtailment to the tune of 8,400 tons p.a. should be put in hand at an early date, and in view of the serious fall which occurred during the first days of April it is believed that this cut will come into force on May 1 next. This announcement undoubtedly came as something of a shock to speculators, who have been hoping against hope that curtailment on the scale practised during the past few months would correct the adverse statistical position and lift the price. In February, confidence received something of a shock from the fact that no announcement was made regarding the holding of the Tin Pool, but according to the March statement this stands at 21,000 tons, and it is a little difficult to understand why no news was given out at the previous meeting. At the moment there is every indication that the Pool will have to add to its burden and that a long period will elapse before any lightening of the load will be achieved.

In the recent debâcle in tin, speculators have played a prominent part, for Paris had apparently gone bull of the metal in hopes of a further fall in the value of the £, and when weakness in the dollar began to lift sterling very rapidly, the fat was in the fire. In sympathy with London values were marked down in the East, and at one stage the market was entirely demoralised, sellers throwing their holdings overboard as if there were no bottom to the fall. Cash tin at one time fell to £106, the lowest level on gold seen for many a long year, and although a sharp recovery came almost at once, the market has worn a very uneasy appearance ever since. On the fall, consumers on both sides of the Atlantic bought fairly freely, but these purchases were probably more in anticipation of business to accrue than against actual orders received. Reference has already been made to the factors in the tin situation, and from a consideration of these it is obvious that the position is a decidedly artificial one. The real bugbear is the holding by the Pool, for although this metal is included in the visible supplies (as published), there is the knowledge that even if this group is strong enough to continue to hold the metal (accumulated at a higher price than that ruling to-day) there must come a time when it will be thrown on to the market. The Lead Pool failed; will the Tin Pool fare any better? According to some it is fated to be a veritable Frankenstein. Salvation of the whole situation lies in an increase in consumption, of which, unfortunately, there are at present few indications.

Notes from I.B.F. Branches.

The annual meeting of the Wales, Monmouth and West of England Branch of the Institute of British Foundrymen was held at the Park Hotel, Cardiff, on April 2, when the following officers and Council were elected for the year:—

President, Mr. W. Williams; *Senior Vice-President*, Mr. Fred J. Taylor, J.P., O.B.E.; *Junior Vice-President*, Mr. Chas. E. Richards.

Branch Council: Messrs. S. Southcott, Ivor Rees, A. Wall, S. Domville, A. Hares, T. D. Richards, C. E. Williams, D. Rogers, W. R. D. Jones.

The hon. secretary, Mr. J. J. McClelland, was unanimously re-elected.

The meeting was followed by a whist drive, at which the President, Mr. Andrew Harley, and Mrs. Harley were present, as also were Mr. and Mrs. C. E. Williams.

Mr. W. Williams extended a hearty welcome to the President of the Institute, and at the conclusion of play Mr. C. E. Williams proposed a hearty vote of thanks to him for coming to South Wales. This was seconded by Mr. McClelland, who stressed the importance of getting the ladies together as much as possible in order to be prepared for the 1933 Convention, which would be held in Cardiff and at which time Mr. C. E. Williams would be installed into the important position of President of the Institute of British Foundrymen.

In response, Mr. Harley said the vote of thanks was all wrong. Rather should he and Mrs. Harley be thanking the Branch for so ably entertaining them. Nevertheless, he did wish to thank them for the warm welcome extended him.

East Midlands.—The East Midlands Branch of the Institute of British Foundrymen held its annual meeting at Loughborough College on April 2, Mr. T. Spiers presiding.

In the course of his report, Mr. H. Bunting, the honorary secretary, said that during the year there had been eight ordinary meetings and one works visit. The average attendance at the meetings was 59. Membership during the year had increased from 140 members to 141 members. An important feature of the year's work was the inauguration of the Lincolnshire Section, and there was every hope of an active Section in that area. The Lincoln Section was fortunate in having the Principal of the Lincoln Technical College, Mr. E. R. Walter, for its honorary secretary. The Branch library had a good year, 29 applications for books being received during the period. This figure did not include the Lincoln Section.

The election of officers for the next session resulted as follows: *President*, Mr. C. W. Bigg; *Senior Vice-President*, Mr. P. A. Russell; *Junior Vice-President*, Mr. A. E. Peace; *Honorary Secretary*, Mr. H. Bunting; *Branch Council*, Messrs. B. Gale, W. H. Smith, H. Sanders and C. Hallamore.

Representatives of General Council, Messrs. T. Spiers, P. A. Russell and A. E. Peace.

At the close of the general business the usual Short Paper Competition was held, the prize being awarded to Mr. C. Sheriff, of Loughborough, for his Paper entitled "The Foundry Apprentice." This is printed elsewhere in this issue.

London Branch.—The annual general meeting of the London Branch of the Institute of British Foundrymen will be held on May 12, instead of April 21, as previously announced. The lecturer on that occasion will be Mr. G. L. Cassidy, who will give a Paper on "Crucible Melting Furnaces."

On the afternoon of May 12 the London Branch will visit the works of the Norton Grinding Wheel Company, Limited, Welwyn Garden City, Welwyn, Herts, and the works of the Welwyn Foundry, Limited.

Random Shots.

An old friend has again cropped up in the correspondence columns of the daily Press—the topic of age. It isn't, this time, about the octogenarian whose longevity is due—so he says—to his daily glass of brown ale. It isn't about the octogenarian whose longevity is due—so he says—to his lifelong teetotalism. It is a question of relative age. Somebody has had the bright idea of writing to an editor that he feels only thirty, although he is seventy. A young *blasé* follows up this shot by declaring that although he is only thirty he already feels seventy. And so the thing starts.

* * *

But the question of relative age is not the simple "older," "younger" business it seems. Some people feel twenty at breakfast, thirty at luncheon, forty at dinner and fifty at midnight. Other people experience exactly the reverse of this, and so endeavour to recapture lost youth by prolonging the daily round into the small hours of the morning after. Then, again, some of us feel thirty at leisure and sixty at work. "Marksman" himself has no personal views about this very feeling subject. He has maintained a stolid forty for years.

* * *

The latest case of barter to come to "Marksman's" knowledge is of a Yugoslavian cinema proprietor, who offers tickets in exchange for agricultural produce. If the system of bartering were ever to be reinstituted, the foundry industry, amongst all other industries, would undoubtedly be particularly well placed. Serving as it does their primary needs in the way of machinery and so on, most manufacturers would have to traffic with the foundryman, obtaining castings in exchange for their own finished products. And when the farmer wanted a new plough-share, the preliminary step would be for him to dig up a sackful of potatoes or pull a dozen cabbages. The only debatable point is whether the supply merchants and equipment manufacturers would accept castings for their commodities, or insist on a share of the day's cabbages. And would the life of cast iron have to be adjusted to equal that of bread and other foodstuffs? "Marksman" confides the problem to the more serious minded of his readers.

* * *

As a people we are fortunate (or should it not be, *unfortunate*?) in having a selection of things which, when we feel so inclined, we can wholeheartedly revile. The Government is an example, but there we stand on a level footing with all countries. (Governments, I suppose, are the object of more public abuse than any other institution under the sun.) But where we are "one up" is in having a matchless climate. The subtle influences of Typical English Weather upon the character of the nation have no doubt played their part in empire building.

* * *

"Marksman" culls the following from a contemporary American trade journal: "In the little circular courteously handed to us at our Hollywood breakfast table last summer, we read about a drinking water that is 'Juvenile.' We wondered what that meant until we followed the asterisk down to the footnote at the bottom of the page, and there learned that 'Juvenile drinking water is the geological term for virgin pure water coming from profound depths, wherein nature's Hydrogen rising through miles of granite dissolves with Oxygen, forming naturally pure H_2O. This is the deep-seated source of—— Spring Water. Being Juvenile, it is fresh, pure, healthful and better tasting.' And so we learn that other things besides gold mines can be 'salted' in this land where men are men and women are glad of it!"

Marksman.

Blowholes and Porosity in Non-Ferrous Castings.

At a joint meeting of the Newcastle Branches of the Institute of British Foundrymen and Institute of Metals, Mr. N. P. Allen, M.Met., gave a lecture on "Some Causes of Unsoundness in Cast Non-Ferrous Metals." In the course of his remarks, Mr. Allen said that it was not necessary to emphasise the difficulties and troubles caused by the presence of cavities in castings. They spoiled the appearance and lowered the strength. If the casting was one which had to be worked mechanically, severe porosity led to failure in the early stages of working, whilst fine cavities produced small surface defects in the finished article. It was not generally realised how great was the porosity of the average casting; the majority of copper castings contained at least 4 per cent. of their volume in holes, aluminium about 3 per cent. and bronze about 2 per cent. There were very few castings at all which did not contain at least ½ per cent. of their volume in cavities. Cavities had no strength, and if one found in the metal ½ per cent. of an impurity which had no strength, one would be very much concerned.

Causes of Cavities.

Apart from faulty moulding practice, the causes of cavities inherent in metal were the presence of dissolved gases and contraction on solidification. The contraction on solidification was constant, and its influence could be guarded against by well-known devices, but the dissolved gases were a variable and little understood factor. In the majority of cases it was impossible to ascertain what they were, where they came from, or in what quantity they were present. That uncertainty was the reason for the extraordinary interest taken in the subject at present.

They knew that gases dissolved in metals; silver dissolved a considerable proportion of oxygen—about twenty times its own volume. Hydrogen dissolved in copper and copper alloys, magnesium, aluminium, gold, silver, platinum, iron and nickel; in fact, there were very few metals which did not dissolve hydrogen.

When a molten metal dissolved a gas, one of three things happened—the gas might be simply dissolved, as sugar was in water, in which case, by treating the metal *in vacuo*, the gas could be extracted, unchanged. The solution of hydrogen in copper was a case of that kind. Alternatively, it might react with the metal, forming a stable compound which dissolved. Under such circumstances, the gas could not be extracted by remelting the metal *in vacuo*. The solution of oxygen in copper and iron afforded examples of that type of action. Again, the gas might be decomposed by its solution in the metal, as sulphur dioxide was when it dissolved in copper, $6Cu+SO_2=Cu_2S+2CuO$. As regards the production of holes, the first and third cases were important. Cavities were likely to be produced in castings when the gas simply dissolved and also when it decomposed.

Factors Affecting Gas Solubility.

The solubility of gas in metal was very much affected by the temperature, and not only did the total solubility increase as the temperature rose but the speed at which the gas entered the metal increased. Consequently it was harmful in general to overheat the metal above the temperature necessary to cast properly. At the melting point there was a marked change in the solubility of the gas in the metal. As a rule, solid metal was capable of dissolving very much less gas than liquid metal, with the result that a liquid metal, saturated with gas, must give up some of its gas on solidifying. Some of that gas would be unable to escape from the casting and would cause blowholes. In form the blowholes differed very widely; sometimes they were smooth and round, as in the case of hydrogen in copper and copper-nickel alloys. Blowholes in bronze took the form of inter-dendritic cavities. Aluminium was rather curious in its behaviour; sometimes big round holes were formed, but most commonly they are of a pronounced inter-dendritic type.

The question of the form of the holes was important, since, when the cavities are inter-dendritic, the castings were likely to be leaky under pressure, whilst castings showing an equal volume of cavities in the rounded form did not exhibit that defect. The difference was largely connected with the time at which the gas began to escape during solidification.

The rate of cooling seemed to have some effect on the form of cavities as well. If the unsoundness caused round holes, it was found that the more quickly the metal was cooled the worse the unsoundness was. With the inter-dendritic type of cavities, the more slowly the metal was cooled the worse the unsoundness was.

Water Vapour and Hydrogen Contamination.

Much doubt had existed as to the sources of the harmful gases present in metals, more particularly as hydrogen, which was the gas most commonly dissolved, was rarely present in the atmosphere of ordinary industrial furnaces; but recent experiments have thrown much light on the problem. Steam in the furnace atmosphere had been shown to react with the molten metal, oxidising it and liberating hydrogen, which dissolved in the metal and produced blow-holes when it was cast. That reaction proceeded very rapidly in aluminium and all aluminium alloys, and aluminium alloys which had been held molten in the presence of gases rich in steam invariably produced castings which were very seriously pinholed. Even with so unreactive a metal as copper, the reaction proceeded sufficiently fast to produce a definite porosity in the resultant castings, and it was quite plain that wherever base metals were melted in contact with water vapour there was a likelihood of hydrogen being absorbed. Not only could water vapour act as a source of hydrogen towards the molten metal at high temperatures, but liquid water at room temperatures could cause contamination.

As long ago as 1868, Graham discovered that many metals, when functioning as cathode in electrolytic cells, were liable to absorb nascent hydrogen, often in very considerable quantities. Ordinary metallic corrosion had since been discovered to be an electrolytic process, some portions of the surface acting as cathodes and others as anodes, and it was not unnatural to suppose that when a metal was allowed to corrode, hydrogen might be absorbed at the cathodic portions. Experiments with aluminium alloys confirmed that supposition in a remarkable manner, for metal which had been exposed to corrosion, either by atmospheric moisture, or by immersion in water, or by immersion in acids, though melted with every precaution to avoid contamination by gases from external sources, in every case produced unsound, pinholed castings, whereas similar metal which had not been so exposed, under similar treatment, produced castings which were comparatively unobjectionable.

Several methods were available for the removal of the gases from a contaminated melt. By allowing the metal to solidify very slowly in the crucible, such gas as was not soluble in the solid metal could be caused to escape, and on subsequent remelting and casting of the material a comparatively sound casting might be obtained. That method, which was known as presolidification, was feasible for small melts but unduly tedious where large quantities were concerned. Alternatively, a gas which was insoluble in the metal (such as nitrogen) might be bubbled through the melt, when it would be found that each bubble of the inert gas took away with it a little of the gas dissolved in the metal until it was all removed. The admission with the gas stream of a substance which reacted with the dissolved gas, such as chlorine, or a volatile chloride, would often hasten the removal, and in that way a very useful degree of degasification could be secured. Care had to be taken, however, to see that the inert gas stream was absolutely free from water vapour, or the production of hydrogen from that source might be very much more rapid than its removal, with the result that the melt would not only not be benefited by the treatment, but actually made worse. Degasification treatments were useful when the metal was initially in a bad condition with regard to gas, but in ordinary cases the improvement was not as a rule very appreciable.

Other Sources of Porosity.

Porosity could result in castings not only from the evolution of dissolved gases but from reactions between constituents of the melt. An interesting case was found in commercial copper, which, though it usually contained hydrogen, rarely contained more than was soluble in the solid copper, so that porosity, due to hydrogen evolution, was rarely found. If, however, copper containing such small quantities of hydrogen was teemed under conditions allowing of absorption of oxygen by the metal during the process, extremely porous castings were obtained, on account of the evolution of steam which took place when the oxygen came into contact with the dissolved hydrogen. In a similar manner, copper containing oxygen, if cast in moulds dressed with an oil composition, showed numerous subcutaneous blow-holes, due to the reaction of the dissolved oxide with the hydrogen present in the oil. Cases of such "reaction unsoundness" were very common. Copper containing sulphur cast perfectly soundly if no oxygen was present, but if oxygen was allowed to come into contact with the metal, porosity resulted from the formation of sulphur dioxide. In nickel-chromium and nickel-copper alloys dissolved hydrogen and oxides could produce a porosity very similar to that found in copper. Steel was liable to cast unsoundly on account of a reaction between dissolved carbon and iron oxide, resulting in a sudden evolution of carbon monoxide as the casting solidified.

Deoxidation.

It was noteworthy that in each case oxygen took part in the objectionable reaction, and that fact threw an interesting light on the process of deoxidation which was so often necessary before a satisfactory casting could be made. In a sense, the term "deoxidation" was unfortunate, because the deoxidising addition, which was always an element with a high affinity for oxygen, such as magnesium, silicon or phosphorus, did not remove the oxygen from the melt, but converted it to an unreactive form, so that the reaction which otherwise would have resulted in the evolution of gases in the casting, could not take place. For example, in the ordinary way, porosity in copper castings was due to a reaction between dissolved hydrogen and cuprous oxide, causing steam to be evolved, just as the ingot solidified. By deoxidation with phosphorus sound ingots were obtained. The phosphorus reduced the cuprous oxide with the formation of phosphoric oxide, which did not readily react with hydrogen, so that no steam was produced and no porosity resulted. The phosphoric oxide did not necessarily escape from the melt, and if the hydrogen content of the metal was sufficiently high, it was quite possible for the phosphoric oxide to be, to some extent, reduced, so that steam was evolved and the deoxidant failed in its purpose. Thus cathode copper, if melted in the ordinary way, could be efficiently deoxidised with 0.02 per cent. of phosphorus, but that addition would not serve if the copper was melted under a flux in such a way as to prevent the escape, during melting, of the large amount of hydrogen which the cathode

copper normally contained. It might be concluded that where reactions involving oxygen were concerned the unsoundness of the ingot depended upon two factors—the reducibility of the oxide present and the reducing power of the melt—as determined by the amount of hydrogen or other reducing agent it contained. That was well illustrated in certain copper-nickel alloys. When the nickel content was below 35 per cent., the oxide formed when oxygen entered the alloys was mainly copper oxide and the alloys behaved like copper. Above 35 per cent. of nickel the oxide present appeared to be mainly nickel oxide, which was less easily reduced than copper oxide, with the result that much more hydrogen had to be present in the alloys before porosity on account of steam liberation could result.

DISCUSSION.

The discussion was opened by Mr. J. W. Craggs (chairman), who said that when Mr. Allen had mentioned the amount of gas which could be dissolved it had reminded him of a serious explosion which had been caused in such a way. He did not remember the details, but since then the same sort of thing had cropped up in aluminium alloys. Was there any particular way in which those alloys should be moved?

Mr. Allen replied that ferro-silicon and certain aluminium alloys were very reactive materials which were liable to react with water vapour, and the trouble might possibly have been due to the hydrogen so formed.

Mr. Newson, referring to the use of chlorine as a degasifying agent, and its forming, with hydrogen, hydrogen chloride, said that would cause hydrogen to be produced in large quantities, which was just what they did not want to occur. With reference to copper, he would like to know in what form P_2O_5 was produced by deoxidation of copper. Was it present as P_2O_5? Mr. Allen had also mentioned the question of gas in bronze, but he had not said anything about gas in brass. Some time ago he had had considerable difficulty with a casting which had been blistered. He had gone to some trouble to find out the reason. It seemed to be due to the small limiting range of copper; it had a freezing point instead of a freezing range.

Mr. Allen said that very little was known about the oxides present in molten alloys. In the case of the trouble with phosphorus addition, it might be that the normal quantity of phosphorus which rendered oxide harmless was useless on account of there being too much reducing gas in the metal. It might be that some difference in the melting practice had caused that particular charge to be higher in hydrogen than it should have been. It was also possible that sulphur had been present.

Mr. Newson suggested that it might have been due to the exposure of the brass to air. Mr. Allen said that he was not prepared to say that that was the cause. With regard to Mr. Newson's question about brass, the freezing range had an effect on unsoundness, but the precise nature of the effect was not yet clear.

Cavities in Ingots.

Mr. W. J. Paulin said that Mr. Allen had somehow left an impression in his mind that everything which had been done formerly had now to be questioned. It was quite a regular thing for oil to be put into ingot moulds before the ingots were poured, but Mr. Allen had told them that by so doing they would get gas which might be absorbed by the metal. Did he advise them to avoid that or would that only occur in certain cases? Some time ago the Newcastle Branch of the Institute of British Foundrymen had been through the Bede Metal Works, and he had been astonished at the marvellous way they obtained solid ingots from which pipes were drawn, and there was a tremendous danger of a slight porous cavity in the ingot being drawn into the pipe and forming a long slit, which examination would not expose. It might be tested to 1,000 lbs. and still not be found, and yet it might have a thickness of only $\frac{3}{8}$ in., but when it came to a bend it would give way. He had mentioned that to show what tremendous possibilities for trouble lay in the slightest porosity. On asking the expert in charge he had told them that he had to see every ingot poured, and if there was the slightest surface disturbance he could tell the place where it had to be cut through to get the cavity. Mr. Paulin also asked whether steam could be absorbed from a sand mould and produce a similar effect during casting as the combination of hydrogen and oxygen. Molten glass was used on the surface of a crucible, but Mr. Allen had said that this would trap oxygen.

Mr. Allen replied that he quite agreed as to the importance of cavities in ingots, as they were capable of producing defects that sometimes were not detected. He did not want them to conclude that all the practices in works were wrong. With regard to oil in an ingot mould, it was dangerous only if the metal contained a reducible oxide. It was, otherwise, useful in preventing the metal absorbing oxygen when it was being poured. The question of steam in moulds was important—it was certainly a deciding factor with magnesium. In order to overcome the difficulties caused by the reaction of steam with magnesium, it was necessary to mix the moulding sand with sulphur, the sulphur forming, during the casting operation, a heavy blanket of vapour which prevented the steam from coming into contact with the magnesium. If the metal was already free from gases and they wanted to prevent gases getting in, then glass would serve as a protection. If the metal was already full of gas then the presence of glass would prevent any of that gas getting away.

Contraction Cavities.

Mr. Wragg said that the question of blowholes round the side of the cast copper bar rather interested him. Might they not have been due to the amount of water in the oil dressing? They knew that if oil was left lying about it would pick up a quantity of water and if moulds were dressed with that oil, steam was liable to get into places where it was not wanted. With regard to the question of the different kinds of cavities due to gas in metal after it solidified, if contraction of the metal was not fully allowed for, there would be some unsoundness. Assuming that something like that took place and was not allowed for, would there not be a gas-free hole? Was it just a question of the gas making the hole or of the hole being there, especially in such material as gun-metal? Another point which he wanted to mention was concerning the solidification of metals containing gases in solution where no reaction took place. In his experience of aluminium alloys, they had a scheme for running the furnace continuously and the molten metal was put into a container until the mould was ready. The castings which were made from that metal which had stood had a much smaller gas content. Was it because while the metal, which was kept just above melting point, was standing it had a chance to eliminate the gas?

Mr. Allen replied that with regard to the question of the water in the oil, it was, of course, a possible cause of unsoundness, but he thought it was relatively unimportant. His point of view about contraction cavities was quite correct; if the metal was cast in such a way as to be liable to produce contraction cavities, then it would become porous with much less gas than would otherwise be necessary. The improvement of aluminium through standing was well known; it depended very much on the condition of the atmosphere, as any water vapour in the atmosphere would be likely to put hydrogen into the metal.

Effect of Casting Rate.

A Member said that he had cast ingots at 1,120 deg. C. and had cast quickly, and they were inclined to show cavities. He had tried casting at the same temperature, but slowly instead of quickly, but the result had been that the ingots were very scabby but quite sound in the centre. Could Mr. Allen give any theory as to which was the correct way to cast?

Mr. Allen replied that he was afraid that he could give no recommendations as to casting without being in a position to take all factors into account. If one cast slowly, one was always likely to get a certain surface scabbiness, whereas with quick casting contraction cavities might form, and such gases as were in the metal would tend to be drawn out.

Mr. Paulin said that it had been mentioned that with certain moulds that were used sulphur was mixed with the sand in order to avoid a question of steam. He had found that to ensure a really solid casting in, say, gun-metal, if one proceeded with the idea that there was gas in the metal the question was to get it out, and that could be done if the metal was kept liquid longer to give the gas a chance of escaping. That could not happen with an iron mould, because a skin was formed, but assuming that one could obtain an absolutely porous container, one would be getting somewhere near the ideal mould, and a tremendous advantage in that respect had been gained by the use of oil-sand cores, which gave very rapid ventilation. If the outside of the mould could be made of similar material one would get something approaching ideal conditions.

A vote of thanks was accorded to Mr. Allen.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Elektron Metal.

To the Editor of The Foundry Trade Journal.

Sir,—We have noticed that from time to time articles are published in your valuable Journal which refer to casting and methods of manufacture of Elektron metal, as, for instance, on January 8, 1931, "A Flux for Magnesium," by W. E. Warner, and on January 21, 1932, "Deoxidisers and Fluxes," by G. L. Bailey.

In the former, reference is made to the use of Elrasal flux, and in the latter the use of sulphur process is mentioned, but in neither case was reference made to the fact that such processes are covered by British Patents held by I. G. Farbenindustrie Aktiengesellschaft.

We would add that we are the sole concessionnaires for the I. G. Farbenindustrie A.-G., Frankfürt a. Main, for Elektron metal, in the United Kingdom, and that casting of these alloys can only be carried out under licence, the licensed foundries in this country being Messrs. Sterling Metals, Limited, of Coventry, and The Birmingham Aluminium Casting (1903) Company, Limited, of Smethwick.

We feel sure that you will appreciate the desirability of reference to patents, wherever they are involved, in articles published in your Journal, and we shall be extremely obliged if you can arrange for such reference to be made in all future articles published.—Yours, etc.,

For F. A. Hughes & Company, Limited,

F. E. P. Haigh.

204, Great Portland Street, London, W.1.

[We feel that the onus should rest with the various authors, as correlation between technical statements and Patent Specification Numbers is too involved for editorial research and citation. —Editor.]

Moulding a High-Duty Hydraulic Cylinder in Loam.*

By J. J. McClelland.

Fig. 1 shows the general appearance of a heavy-duty hydraulic cylinder, together with a sectional view. It appears to be a very plain casting, but is not as simple as it looks. In moulding, one would not core out the pressure hole; this would be solid and would be machined afterwards. Very often such castings are made with brackets cast on. The cylinder is not very heavy. It would weigh about 4 tons. There would be a working pressure of about 1 ton per sq. in., and the ram there would be a pressure of about 254½ tons.

The cylinder is constructed to accommodate pressure when the job is cast. It is not wise to cast this solid, as a plate with holes is stronger than one cast in a solid piece. The centre hole is advantageous and helps to resist contraction. Further holes are scattered about the plate. These are not meant to save weight and cores are not necessary. Very often old half-bricks are used.

Having made the plate, it is set up on three blocks of ½ cwt. The whole must be made rigid and level. The spindle is secured at the top with a bracket to the foundry wall. The moulder builds up with bricks for the first stage and strickles out the bottom part with loam. A runner should be built in the brickwork.

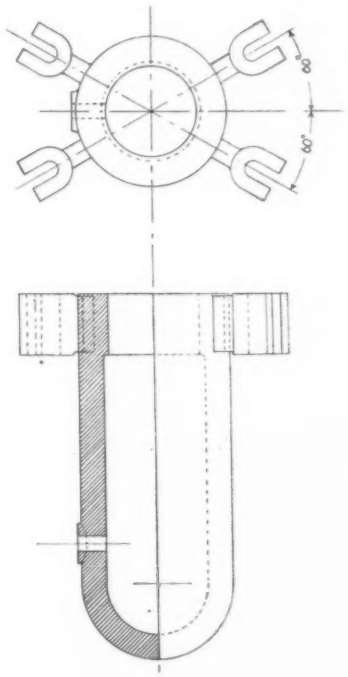


Fig. 1.—General Appearance of Heavy-duty Hydraulic Cylinder.

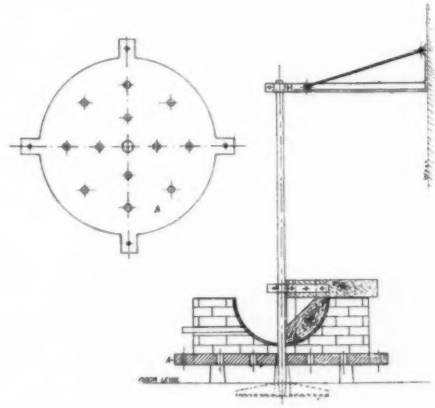


Fig. 2 shows the Method of Moulding Suggested.

Fig. 3 shows the second stage, incorporating a ring which carries the middle part of the job. This ring has prods cast on it. It has to be loamed up and turned over. After the second stage is built up, it must have the strickle board run over it.

Fig. 4 illustrates the ring plate which lifts the central portion built up to bracket level. Probably the pattern shop will only supply one pattern of the bracket with a straight edge; therefore one must strike a centre line and then strike four other lines at an angle of 60 deg. This would not be necessary if a template were available.

If one only had one arm pattern, one would have to place a centre line and build up until level with the second strickle board. Having built up one, the pattern can be drawn and the operation repeated until four parts have been accomplished. After building up the middle part, it is dried in the stove and the building of the core continued. A bottom lifting plate is made as illustrated. This has to be turned over and coke is filled in between the prongs, whilst it is loamed up outside. It is then dried and turned over and the bottom part filled up with black sand, then strickled out to allow room for the plate to sit therein.

Fig. 5 shows the assembled mould ready for lowering into the pit for casting. Suspended from a cross beam are four stirrups which come down to the bottom lug. They answer two purposes: that of lifting and as a binder, after the top plate has been put on. Packing is then put under the beam and this is backed up with forged wedges. In making this top plate, allowance must be made for putting in a ring at the top. The running arrangements are clearly detailed.

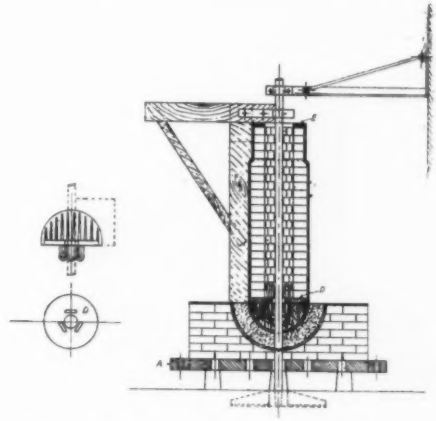


Fig. 4 shows the Ring Plate for lifting the Central Portion.

In making a top plate, the pressure has to be allowed for and the runners must be in the correct position to ensure a good running of metal.

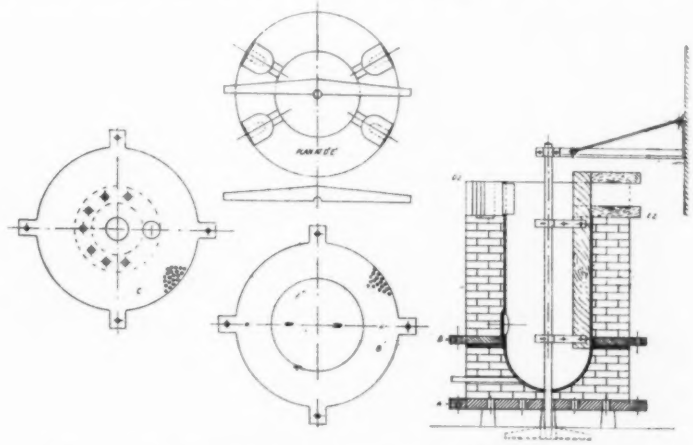


Fig. 3.—Second Stage in the suggested Method of Moulding.

The core is suspended from the top plate. There are three hook bolts which are hooked into three staples. These are bolted up with strong washers and plates. It is advisable to have some pieces of tubing or bars to drop in and wedge underneath the top plate. After this, it is safer to throw on some small coke and ashes and fill it up well to strengthen the brickwork.

1¼-ton pressure, so it will be seen with 254 plus 25 per cent. there would be over 300-ton pressure on the ram face and on a similar area on the walls of the cylinder, consequently, the cylinder must be free from defect. A peculiarity is the shape of the base. Some may wonder why it is not flat. There is good reason as far as design is concerned and also from a strength point of view. It is generally agreed that the cylinder is strongest when made to the shape illustrated. Four arms secure the uprights and also support the pressure head. They also act as a guide for the follower.

Fig. 2 shows the method of moulding. The core must be maintained in a central position or there is a danger of the pressure having a serious effect upon the weaker portions. The core must also be secured without the aid of chaplets. In the first place, one beds in the foundry floor a small spider, with a tapered hole rather than a peg top, because it wears better and also holds the spindle more satisfactorily. There must be a foundation plate which must hold all for which it is intended. It must not only carry the load, but withstand load and

* A Paper read before the Wales and Monmouth Branch of the Institute of British Foundrymen, Mr. R. G. Williams presiding.

After closing the job and securing it, it is lifted and lowered into the pit, because no brickwork would stand the strain unless the job was so secured. The usual practice is to ram up well after putting into the pit. In doing this, the bottom runner is covered with a cake, and cores with a runner running down the centre are utilised. It is not really necessary to make these cores, but with a runner stick there is the danger from dirt. There is also the dry-sand core, which will not wash so easily. In most cases the job is not completely buried, and this gives a better chance for the metal from the ladle to feed it.

In conclusion, the author wishes to express his thanks to Mr. W. R. D. Jones for making the slides which have been used to illustrate this

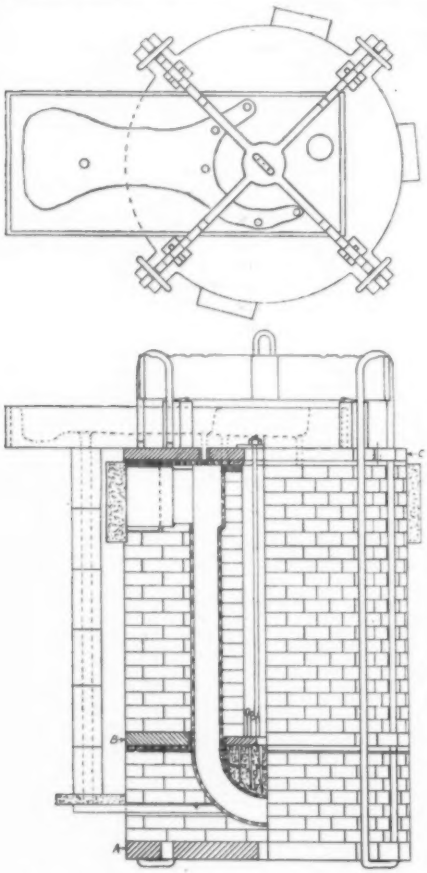


Fig. 5 shows the Assembled Mould ready for lowering into the Casting Pit.

Paper, the object of which has been to encourage the younger element to obtain a knowledge of draughtsmanship.

DISCUSSION.

Mr. R. J. Richardson asked what system was adopted for making the core iron at the bottom. The average man could not gauge it to ensure a correct fit.

Mr. McClelland explained this was strickled out in the same way as it would be done with loam. In answer to Mr. Howe, who asked how the core was taken out of the job after it had been struck up, Mr. McClelland said it was lifted and taken to the stove. The main advantage of the system advocated was that the core was suspended in a particular position all the time and that chaplets were not necessary.

Mr. R. G. Williams asked whether the mould would be lifted away when striking up the core and how could one be sure the mould carried the correct thickness of metal all through?

Mr. McClelland replied that when the top plate was lifted away it was possible to see the position of the core.

Mr. R. G. Williams thought there was a risk of the casting being dirty. Would it not be better to cast the reverse way up?

Mr. McClelland replied that he would not care to take the risk of casting as suggested, as the job might not withstand the pressure. A little dirt in the top would not matter, for there was usually a fair amount left on for machining, but it would be a very serious matter if there was dirt in the bottom.

Mr. R. J. Richardson wished to know how the lugs were drawn out, and was informed that a flat joint was made on sides and when the lugs were taken away a core was inserted and covered with loam cake.

Replying to another question as to how the joints were registered, the speaker reminded the meeting that this work was being made in loam, and when the whole mould was assembled one had a very good view of everything.

In answer to Mr. Hird as to whether any precaution was taken to resist pressure of metal on the outside runner, Mr. McClelland said that one could put a moulding box right at the bottom in case the core should burst. That was one of the reasons for using a core.

In answer to Mr. C. E. Williams as to whether pig only was used, the Lecturer said it was a 50/50 mixture of best hematite pig and scrap. The bottom runner was not inserted at an angle, neither was a key brick used for releasing the core, because with 3-in. material and a job of 20-in. dia. this would not be at all necessary.

In reply to Mr. Kinsman, Mr. McClelland said the down runners were 3 in. and the gate runner 2½ in. With a good core there was no side wash. This job had been made in America some years also by two men in two weeks.

Mr. R. G. Williams asked whether it would not be advisable to give a 10-in. head to avoid the scrum, and Mr. McClelland agreed a head would undoubtedly be an advantage.

In thanking Mr. McClelland, Mr. C. E. Williams said the evening had been interesting and helpful. Mr. R. G. Williams seconded the vote of thanks, adding it was always a pleasure to sing the praises of the hon. secretary, who never tired of working on behalf of the Institute and who had shown great ability in giving this extempore talk.

A New Type of Moulders' Boot.

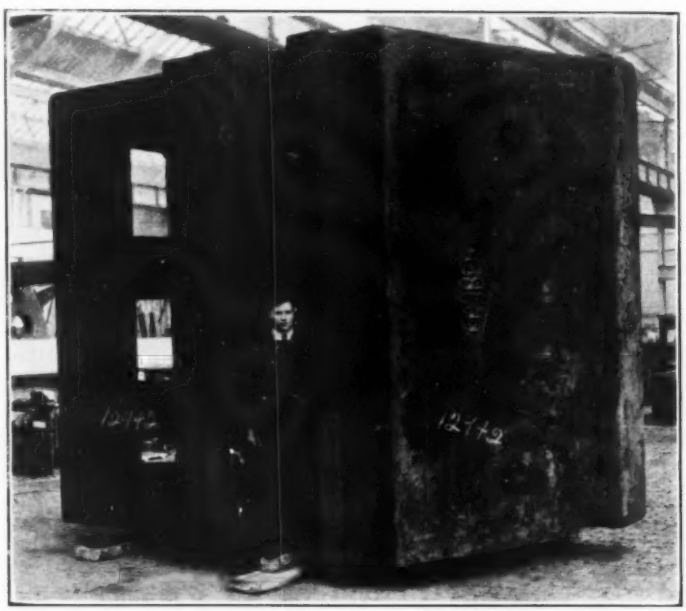
Mr. Geo. Nield, of 3, Baden Terrace, Hough End, Bramley, Leeds, has designed a new type of boot suitable for foundry workers. As will be seen from our illustration, the lace holes are completely enveloped by an external tongue,

A New Type of Moulders' Boot.

which fastens at the back of the boot, and so effectually prevents the entrance of splashes of liquid metal, dust and dirt. Moreover, by maintaining the normal method of lacing, the individual can adjust tightness to his own particular liking.

A Large Lathe Casting.

Our illustration shows the headstock casting for a large lathe (72-in. centres) which is being manufactured for export by Messrs. Craven Brothers (Manchester), Limited, Stockport.



Headstock Casting for a 72-in. Centre Lathe being made by Messrs. Craven Brothers (Manchester), Limited.

The casting weighs 26 tons and is part of an order which calls for 70 machines, 45 of which are centre lathes ranging in size from 16- to 72-in. centres, whilst the remainder is made up of roll-turning lathes, ingot-skimming lathes and horizontal boring machines.

In pursuance of its policy of restricting imports in order to protect the home market, the French Government has published a decree fixing quotas for gas, oil and petrol stoves.

The Testing of Iron Castings.*

By A. W. Walker.

Iron castings have been made for many hundreds of years, but it was not until the time of Fairburn and Hodgkinson, in the middle of the nineteenth century, that systematic tests for strength properties were carried out. The rapid advances which have taken place in the metallurgical knowledge of cast iron during the past 30 years have been closely linked up with the control of the chemical analysis and the testing of the mechanical properties, and now it is quite usual for tensile and transverse strengths to be specified as well as in some cases Brinell hardness, shock strength, magnetic permeability and chemical analysis. The main advantage that cast iron has over other forms of ferrous materials is the ease with which it can be made to shape, and the comparative rigidity of the cast structure. This makes cast iron very useful for parts which are subjected to mechanical and thermal influences and which must not distort under these stresses. In addition, cast iron is a relatively cheap material and possesses properties in the fluid state which enable it to take a correct shape in a mould and to be relatively free from casting defects.

Factors Influencing Strength.

The limit in strength of ordinary cast iron can be placed at about 15 tons per sq. in. tensile strength, although special cast irons up to 30 tons tensile are being made on a commercial basis. The strength of cast iron varies with two main factors:—(1) Casting thickness, and (2) silicon content. With regard to casting thickness, it is well known that a thick portion of a casting will be coarser in grain and consequently weaker than a thin portion of the same casting. The existence of this variation is recognised in the standard British specification, British Standards Institution No. 321 of 1928, which calls for a test-bar to be cast representing the average thickness of the casting. The three test-bars specified are roughly $\frac{3}{8}$ in., $1\frac{1}{4}$ in. and $2\frac{1}{4}$ in. dia. and the mechanical requirements are lower for the larger bars.

With reference to the silicon content, the influence of this element was pointed out by Prof. Turner in his classic researches at the end of the last century and silicon control is now a regular feature of all foundry mixtures. The lower the silicon content the finer the grain will be in the resulting casting, and consequently the silicon content for a given casting is fixed to give the required closeness of grain for a given thickness. In the case of castings with varying thickness the silicon content has to be taken for the average section, although care must be taken that with very thin sections the silicon is not so low that the casting will become white or mottled, and on the other hand, in the case of the larger sections, the silicon should not be so high that the structure is unduly coarse. During the last few years a large amount of research work and practical experiment has been carried out in an endeavour to correlate the casting thickness with silicon content and other factors. The general tendency appears to be that the sum of the total carbon and the silicon contents and the casting thickness should be corrected together, and these two elements are usually fixed to give in the castings a structure known as the pearlitic condition. The pearlitic condition is taken to represent a combined carbon content in the casting of 0.7 to 0.9 per cent., the remainder of the carbon, of course, being present in the form of graphite. Another line of investigation has been the influence of the size and nature of the graphite flakes on the mechanical properties.

* Paper read before the West Yorkshire Branch of the Institute of British Foundrymen, Mr. H. G. Cran presiding.

Transverse Test.

Up to recently the transverse test has been carried out on two types of bars, one bar being 2 in. by 1 in. in section, resting on supports 36 in. apart, the breaking load being applied at the centre of the bar. For common castings a breaking load of 28 cwts. is required, while for higher-quality castings 30 cwts. or even up to 40 cwts. may be specified. This breaking load is approximately equivalent to a tensile strength of 10 tons per sq. in. Another bar such as has been used by the Admiralty is 1 in. square in section and tested on centres 12 in. apart, the breaking load required being 2,000 lbs., this being equivalent to a tensile strength of 9 tons per sq. in. The new B.S.I. specification demands round bars of the diameters mentioned above, the distance between the supports being 12 in. for the small bar and 18 in. for the two larger sizes. The tensile requirements are 10 to 12 tons per sq. in., the higher value being specified for the smaller diameter bar, and for very common castings 9 to 10 tons tensile are specified. It has been shown recently that the round transverse bar gives a better breaking load than the square bar, and for this reason foundrymen should adopt the round bar rather than the square bar. It is customary in making the transverse test to measure the deflection at the breaking load, but at present little useful information can be obtained from the deflection figure, although work is being carried out which may render this value of considerable use in estimating the tenacity of a cast iron.

Recently, through a strange interpretation of the Admiralty specification for a 1-in. square bar broken on 12-in. centres, it was found that this particular bar had a critical point during test. Thus, if a record be taken at every 250 lbs. of load, this bar gives a deflection of 0.08 in. at 2,000 lbs. of load under normal circumstances, but where a loss in deflection occurs it does so at 1,500 lbs. without exception, and that loss is always one of 0.01 of an inch. This is never regained if the loss in deflection occurs at 1,500 lbs. All normal bars show a rise in deflection of 0.02 of an inch per 500 lbs. of load. Data were also collected on bars of other forms, and the whole work done is valuable in estimating the tenacity of cast iron under load.

Tensile Test.

The tensile test is usually carried out on a test-bar machined from an original broken transverse bar or a specially cast tensile test-bar. The manner or position in which a tensile bar is cast may have some relation to the ultimate result, but sometimes the bar cast in what would be assumed to be the least correct position will give a reading far in excess of the bar cast in the more favourable position. In some cases the tensile test-piece is cast already shaped and merely requires a skimming-up to give a bar of uniform dimensions. It has been usual in the past to machine a tensile test-piece for cast iron with a parallel gauge length of about 2 in., such as is commonly used for measuring the elongation of steel. As, however, cast iron has no appreciable elongation in tensile, this parallel portion of the bar is unnecessary, and many Continental and American testing authorities now omit it. The tensile strength is reported as tons per square inch breaking load, and this is the most commonly used figure when referring to the strength of cast iron. As, however, castings are more often used in compression, it is somewhat surprising to find that compression tests are not regularly specified. The compressive strength of cast iron is about four times the tensile strength, while the transverse strength, when worked out as a rupture stress, is usually twice the tensile strength.

Brinell Hardness.

The Brinell hardness is regularly taken on cast iron with a view to determining the ease of machinability as well as obtaining some indication of the quality of the cast iron. Generally speaking, it may be said that the pearlitic type of cast iron varies in Brinell hardness from about 180 Brinell units up to 220 Brinell units. If the Brinell hardness is lower than this range, the castings are on the soft side, and should be more readily machinable, although somewhat weaker in mechanical properties. If, however, the Brinell hardness exceeds the range given, it can be taken that the castings are on the hard side for machinability, and the tensile strength will usually be high. Where nickel is present, however, the Brinell hardness can be as high as 250 without undue machining difficulties. Strictly, there is no very close connection between machinability and Brinell hardness or between tensile strength and Brinell hardness, but there is a general relationship which makes the Brinell test very useful.

Special Cast Iron.

Recently a number of special cast irons has been introduced, both for general good-quality castings and also for special purposes. These processes followed the development during the war of what was known as semi-steel, which is really a wrong name and would be more suitably described as steel-mix cast iron. The use of steel in cupola charges is useful from the point of view of cheapness, and also for reducing the carbon and silicon contents to give a stronger cast iron from a given pig-iron and scrap mixture. The amount of steel which can be used varies from 5 to 95 per cent., and is a subject which cannot be dealt with in detail here. The Lanz hot mould or Perlit process was brought forward some eight years ago, the main feature being the use of sand moulds heated to temperatures of 300 to 500 deg. C., and into these moulds was cast a mixture which, if poured into a cold mould, would give a mottled or hard cast iron. The slower cooling in the hot mould results in the formation of an all-pearlitic structure which gives the best all-round strength properties.

Another process is the Emmel process, utilising a high percentage of steel in the cupola, which produces a low carbon cast iron which is balanced by having a silicon content higher than is normal for good engineering castings.

Following on these two processes are many developments in this direction, as well as the use of alloys, such as nickel, chromium, molybdenum, titanium and vanadium. During the last three or four years rapid strides have been made in the direction of heat-treated cast irons for special purposes, and at the same time a type of cast iron known as austenitic cast iron, which contains high percentages of nickel, copper, chromium, etc., has been brought forward. These irons are naturally more expensive than the ordinary run of cast iron, but are finding useful applications for special jobs where high wear resistance, corrosion resistance, high-temperature service or extreme toughness is required.

The author's firm finds that a small copper percentage added to a very ordinary mixture gives a metal of much finer grain size, and raises this mixture from 16 tons to just over 17 tons per sq. in. tensile. Whether the corrosion resistance is better is not yet established, but that is the ultimate aim. By some peculiar reaction the deflection at break is not quite so good as the copper-free mixture, although it rises under load fairly evenly, until it exceeds 2,500 lbs. This, of course, is not what one would expect with a cast iron carrying copper.

DISCUSSION.

Engineers Reliance on Tensile.

Mr. R. D. Welford, opening the discussion, said Mr. Walker had mentioned Fairburn's

book and stated that that writer was about the first to test cast iron. That was true, and one way was actually to break castings. Mr. Welford mentioned that he possessed the mixture for the metal used in the beams at Saltaire Mills. They were of such an excellent quality that if ever those beams were to come into the market any foundryman would be well advised to buy them. They were made from cold-blast iron, which nowadays was rather expensive to use in ordinary castings. He fully agreed with Mr. Walker's statement that the method of using round test-bars cast to sizes approximating to the different thicknesses of the casting was preferable; that was, indeed, the only way to get a fair representation of the strength of the casting as a whole. Although engineers usually insisted on a tensile test, that test in the majority of cases was not really one the equivalent of which was called into service so much as the compression test. But engineers were more familiar with the tensile test than others, knowing that if they specified a test of, say, 14 tons, they would get a fairly close-grained, strong material. Routine testing in the foundry was undoubtedly of great importance. The machine in many tests was not mechanically perfect, and it was not always pulling in an absolutely consistent direction, and the result may be a break at a less tonnage than in the case of another one in the machine. It was no easy matter for a foundry manager to run his tests absolutely correctly unless he had metallurgical assistance, because he was usually working largely in a kind of blind alley owing to having to take the average analysis supplied by the blast-furnace people and had to work on that. His calculations were sometimes faulty because the metals given to him were not quite in accordance with the published analysis. If routine testing were carried out on a machine a man was handling regularly, one could always tell whether one's metal was being produced according to the quality desired even if the test was not of definite scientific accuracy; one did, at any rate, know one was going on the right road.

Mr. Walker, responding to Mr. Welford's observations, said at the Broadbent foundry they tested their metal regularly and got analyses of the irons as they came in, and they knew all the time just where they were working. They did not, however, actually test their mixtures on the spot but sent them to wherever the inspectors requested.

Copper in Cast Iron.

Mr. A. S. Worcester (Branch-President) said it was a curious coincidence that Mr. Walker had happened to touch that day on more or less the same subject as had been gone into very fully by Dr. Swift at their February meeting, though Mr. Walker, who had not been present on that occasion, was perhaps not aware of it. A point he (Mr. Worcester) wanted to stress particularly was that a test of the metal was quite a different thing from a test of the casting, because they as foundrymen had to put a lot more into their craft in getting their castings to stand up to what was required of them. The unequal sections they were liable to encounter, and strains that were set up in the cooling, etc., made it a duty for the founders to produce castings with the strength in them that should be there. The Institute of British Foundrymen had been giving considerable attention to this subject of testing for some years. They had thought the round bar was perhaps the solution of the problem, but it seemed to be a matter on which finality had by no means yet been reached. The Institute had now a special technical committee going into the matter very fully. Dr. Swift had proved very definitely, in his Paper to the West Riding Branch last winter, that the test of a casting was different from that of a test-bar. At the same time, data now available showed that of test-bars, the British bars in the three different sizes were the best in the world and would provide a test meeting practically every requirement the engineer could want. Some of the older testing machines, of course, were not built for working with the new round bars, and it would take time to convert them all.

The silicon test was one of the oldest and, in the view of the speaker, one of the best for routine testing to set up a working standard in the foundry. Mr. Walker had mentioned the compression test, but he personally thought that was rarely required, as the iron was usually many times what was required of it in that direction. Mr. Walker had mentioned the various alloys mixed with cast iron to-day, and evidently these things were having a beneficial effect on the iron. The mention of the addition of copper to iron brought to the speaker's mind an old foundryman, who was so convinced of the value of a little copper that he always put fourpence in the shank to get a better test-bar.

Mr. Walker, replying, said copper did bring up the tensile strength, but, so far as his own experiments had shown up to date, it did not seem to be of any help in regard to the transverse bar. What he was after in his experiments was deflection in the test-bar, and the copper had not, up to date, shown any sign of helpfulness in that respect.

In answer to Mr. Carter, who asked whether there was any information available as to the proportion of copper already existing with other elements in the iron, Mr. Walker said he had not entered the analytical side of the matter. At present the work was only on the physical side, but when they had completed the data in that direction they would be able to get on further.

Brinell Hardness Beneath the Skin.

Dr. Ward, of the Engineering Department of Huddersfield Technical College, said Yorkshire foundries had a very real advantage, on the whole, in being within fairly easy reach of technical colleges with substantial engineering departments, and the majority of these colleges had testing machines which, he was quite sure, they would be delighted to use for the assistance of the foundry industry of their areas. Without advertising, he felt he ought to mention that at Huddersfield Technical College they were always willing to carry out a test at a nominal charge. He would like their machine to be put to more use by the industry, and the reports from it would be regarded as confidential to the foundries concerned. At present the machine was equipped for testing the square bars, but he was quite prepared to arrange for it to be fitted to take the round bar. In the matter of the Brinell test, he was not very familiar with testing cast iron for hardness. He would like to carry out an experiment in removing the skin of a metal and seeing how the Brinell numbers reacted to depth below the skin.

Mr. Walker said he had done some experiments in that direction. Taking a figure of 220 on the surface and machining the skin, it then dropped to 217: more deeply it dropped to 207. That was roughly the variation which took place on the different positions with Brinell testing under those conditions. He did not know what relation it had to different silicon contents.

High-Phosphorus Pig and Cavities.

Mr. W. Parker said he had some tests for Brinell hardness in regard to rather large lathe castings. On the skin it gave 269. On machining, it dropped to as low as 170 in parts, but he could get 220 all round the edge. The order required a minimum of 190. The only way he achieved that was by controlling the silicon at about 1.06 per cent. Daily tests were taken, and it was considered that if, in the straight cast iron, one maintained about 1.90 per cent. silicon and the manganese about 0.48 per cent., one could rely on the correct Brinell hardness (about 229) on the test-bar with the skin ground off. In the transverse test of the soft grade of iron an endeavour was made to have 25 cwts. and 32 to 34 cwts. with semi-steel, on which the Brinell hardness was between 249 and 269. The difficulty experienced, however, was with the high-phosphorus pig-iron now coming in. Because of the coke deteriorating and the use of pig having this high phosphorus content, the matter had become rather a problem, and he would be glad if anybody could give him advice as to eliminating this phosphorus. He had tried various methods; one got absolutely clear of dirt, but, owing to this phosphorus trouble, tended to get big cavities on the big castings.

Mr. H. Sayers remarked that nobody seemed to have a good word for the old-fashioned test-bar, but he felt there was still a good deal to say in its favour. It was much easier to use a 2-in. by 1-in. bar with a flat joint than a round bar. The whole trend of modern metallurgy had been to do away with the difference between the thin section and the thick. They were all endeavouring to get away from the mass effect. For wrought-iron shop testing, the transverse bar was useful, and a chill test gave a good idea of the homeogeneity of the metal. In regard to Mr. Parker's complaint of the phosphorus pig-iron, that was a serious and growing trouble, and something would undoubtedly have to be found for removing that excessive phosphorus.

Mr. Walker said he had not had the phosphorus trouble mentioned by Mr. Parker, and without knowing the local conditions in Mr. Parker's case he could hardly venture to offer any advice in the matter. One was afraid that if they were going to endeavour to remove the phosphorus in the blast furnace, the cost of pig-iron would go up something approaching 100 per cent.

Mr. W. G. Thornton, moving a vote of thanks to Mr. Walker for his Paper, said he was glad the speaker had commended the new standard three size system of test-bar. Personally, he felt this was the most fair method of testing castings that the industry had had up to date. Even so, there was as yet no test-bar which would give absolutely the relative value of the casting itself owing to the varying conditions in producing the test-bar and the actual casting. The industry had no doubt quite a long way still to go before they got completely over this problem. He was glad Mr. Walker had specially mentioned the relative position of test-bars to castings. Many foundrymen, one was afraid, did not fully realise the importance of this point.

A State of Flux.

Mr. S. W. Wise (hon. secretary), seconding the motion, said Mr. Walker was especially to be thanked for having, after preparing a full-length Paper, cut it down at short notice to a size suitable to the brief time available in a meeting following a works visit. If there was one subject more discussed and debated in foundry-trade circles than others, it was this controversial question of test-bars. Nobody was really satisfied with them. Even if an engineer got a test which came absolutely up to his expectations he began to wonder whether it was genuine. The foundryman himself did not regard the test-bar as of really sound value in regard to its relativity to the casting; and the methods of taking tests on bars were so many and varied that one doubted whether anybody attached really a great deal of importance to them as regarded the soundness of the casting. The industry had been offered a host of suggested antidotes for bad iron, but he was afraid much would have to be re-written still on the problems of cast iron. Mr. Walker, for instance, was using an iron which the average foundry would probably turn down at sight and the average chemist would reject on analysis—yet it was one of the most serviceable irons in the industry. He (Mr. Wise) was familiar with that iron. He had used it for years and, like Mr. Walker, he

(*Concluded on page* 235.)

Nickeliferous Cast Iron.

Following Dr. Everest's interesting Paper on "Cast Irons with High Nickel Additions," which appeared in recent issues of THE FOUNDRY TRADE JOURNAL and which was presented to the Scottish Branch of the Institute of British Foundrymen, a useful discussion ensued, of which the following is an abstract:

DISCUSSION.

MR. MCMANUS said that everyone must feel much indebted to Dr. Everest for coming to them again. Although he had given them an interesting Paper two years ago, the matter which he had put before them that day was entirely new, and represented a big advance in the production, treatment and application of alloy cast irons. He himself had had something to do with "Nimol," and would like to make it clear that it was not quite so easy to handle as it might have appeared to them from Dr. Everest's lecture. "Nimol" had a high shrinkage and required very big heads to secure satisfactory results. It required controlling very carefully, but it was a really good iron, although very difficult to machine.

MR. J. ARNOTT said that cast iron was for long considered the Cinderella among metals, and it was probably true, inasmuch as the development was slow compared to that made in steel metallurgy. The progress during the post-war period had been really remarkable, and it was pleasant to know that at last cast iron was coming into its own. The results of post-war work in alloy irons was quite romantic. To those who had studied steel metallurgy it was remarkable to find that the same process of development was taking place in regard to cast iron. In the first place, the addition of special elements, such as nickel, etc., followed by heat-treatment produced the high-duty steels now so well known and largely used. The same process had been carried out with cast iron; the addition of other metals had been employed for some time, and, now, as Dr. Everest had shown, heat-treatment was employed to develop the highest properties. It might be thought that these irons were only suitable for special jobs, but there were many possible applications and jobs waiting for these special cast irons. Dr. Everest's Paper had been very clear, and quite a model for those members who wished to give Papers.

A Word of Warning.

Dr. Everest had mentioned that these alloy irons, when heat-treated were uniform throughout the mass, as shown by uniform hardness, and were therefore free from strains. He thought it was dangerous to argue that, because the hardness appeared to be uniform, there was no strain in the metal. Steels tempered to uniform hardness were found to be strained because cracks were formed, due to delays in tempering, and one could not argue that uniform hardness was evidence of absence of strain. He appreciated the work that Dr. Everest had done in collecting so much data, and he felt gratified that this subject originated in Britain and the development had taken place in this country and not abroad.

A Piston Ring Problem.

MR. F. HUDSON said there were one or two points upon which he would like to have Dr. Everest's advice. He was sorry that he had not heard the Paper about three weeks ago, because it would have helped him very much in regard to a matter with which he had had to deal. The question of wear was a matter of first-class importance in all big engineering works, and he had had to go into that question of late. He had the case of trouble arising through the wear of the piston rings in a compressed-air hammer. He knew of a case where the rings wore so low that it was necessary to have a new cylinder, because they used steel piston rings. Originally the rings were of cast iron, but they broke so persistently that the engineers were forced to use steel rings and the result was a new cylinder. The engineer asked if it were possible to buy centrifugally-cast alloy piston rings to stand up to the wear, and he would like to have Dr. Everest's opinion as to whether centrifugally-cast rings were superior to sand-cast rings, and if he thought they would be an improvement. With regard to the alloys not being quite right and showing the effects of work hardness and tempering: taking austenitic cast irons it was recognised that manganese steel after casting was relatively hard, and it could be softened by quenching. If the alloys to which Dr. Everest had referred were found to be not quite correct and showed work hardness, could they correct that by tempering? He also wished to ask about the use of "Nimol," "Nomag" and the other alloys shown in the table, because he noticed that only "Nicro-silal" was marked as being a patented article, and he would like to know whether anyone could use "Nimol" or "Nomag." He thanked Dr. Everest for having given them so interesting and informative a Paper containing so much new material.

MR. BUCHANAN said that Dr. Everest had dealt with a very fascinating subject. The heat-treatment of cast iron should present little difficulty if they took a leaf out of the book of the steel-maker. It was well known that these high-alloy cast irons could be produced in the cupola quite easily, but that the best conditions were not obtained in the material as-cast, but that heat-treatment could modify the properties of the material. The Mirrlees-Watson material which Dr. Everest had mentioned was an ordinary nickel cast iron and could be machined even at 270 Brinell. The most important factor in his case was the wear resistance. By quenching and tempering the wear was reduced by about 50 per cent. If the life of the material could be practically doubled, heat-treatment of cast iron was certainly worth while.

Author's Reply.

DR. EVEREST, in replying to the discussion, said that he wished to thank Mr. Arnott for his remarks. He agreed that the heat-treatment of cast iron had been developed more in this country than abroad. It had been due chiefly to Mr. Hurst, who, appreciating the urgency for meeting the demands of the automobile industry, had started to investigate the possibilities of the heat-treatment of the alloy irons. He was still investigating and doing excellent work. Replying to Mr. Hudson regarding the matter of the air-hammer piston rings, he suggested that heat-treated alloy cast iron should be used. With regard to the softening of austenitic cast irons by quenching, this could satisfactorily be effected provided the material was heated for a sufficient time to a high temperature. Regarding the Patent position, there was a good deal of misapprehension. In the case of "Nicro-silal" the Patent covered essentially the high-silicon content—over 4 per cent. In the case of high-nickel cast irons, although Patents had been taken out they had mostly lapsed.

Mr. Buchanan's results were particularly valuable, because they were confirmatory and complementary to the results obtained by Mr. Hurst. They were an improvement because Mr. Hurst's results were obtained on piston rings, but Mr. Buchanan's were obtained from simple tensile test-bars and therefore more comparable with ordinary practice. He agreed with Mr. Buchanan that if the life of the material could be doubled in regard to wear, heat-treatment was certainly worth while. He thought that it was only a matter of time when all wearing parts of castings would be made in that type of material.

MR. N. MCMANUS said that the dearth of discussion suggested that Dr. Everest had been very conclusive. He thought that had a foundryman who had not been reading the technical Press come into the room whilst the Paper was being delivered, he might have thought that he had stumbled into a steel lecture. It seemed to suggest that cast iron had still a good life ahead, and he thought that in spite of the gloomy predictions that they had heard as to the demise of cast iron, if they had to tackle and develop these new metals their cupolas would not be out of blast for a very long time. He asked them to record their thanks to Dr. Everest for the interesting Paper he had given them.

The Testing of Iron Castings.

(*Concluded from page* 234.)

got excellent results with it. The question of porosity, among other things, was one on which most of what had been written would probably have to be revised in the light of further knowledge gradually coming to light.

MR. WALKER, replying to the vote of thanks, said systematic investigation and experiment had resulted in finding out a good deal of useful information about test-bars and the testing of cast iron under different loads and relating to the tenacity of cast iron. One took it for granted that a test-bar should give a certain deflection when it broke, but one had come across another angle recently which expressed that the deflection should take place at the specified load. The question of test-bars was undoubtedly one of much controversy and was probably one about which the industry would still be debating a hundred years hence. The only thoroughly effective method of testing a casting seemed to be to break the casting itself and test the sections—but who was going to pay for the casting? His Paper that day had necessarily been of a very sketchy character and perhaps hardly representative of the experiments and inquiries it represented. He hoped he might have the opportunity on another occasion of dealing with the matter more fully.

Iron Sponge, Its Production and Use in Modern Steel Practice.

The following is a summary of a Paper on this subject by ARVID JOHANSSON in a recent issue of "Jernkontorets Annaler":—

The different reducing agents, solid carbon and gas, which may be employed for the reduction of iron ore without smelting, are discussed. Solid carbon is used in Kalling's process. Two different kinds of reducing gas have been employed. In the Norsk Staal and M. Wiberg processes a circulating gas with a very low nitrogen content is used. Having passed the reduction zone of the furnace, the gas is conducted to an electrically-heated carburiser, where it is regenerated. In S. Ekelund's process producer gas practically free from CO_2 and of a sufficiently high temperature for reduction (about 1,000 deg. C.) is obtained from a producer of special construction.

Different types of reduction furnaces are discussed. The ore may be either a sinter very rich in iron or a poorer lump ore, especially a siliceous hematite with about 45 per cent. iron. In the latter case the crude sponge must be concentrated. Such a concentration may be done by the wet-magnetic method. Provided certain precautions are taken, there is no risk of oxidation of the sponge.

The metallurgical importance of a thorough reduction and of a high and uniform quality of the sponge are stressed. Especially when the sponge is smelted in electric furnace with only a small addition of pig-iron, an inferior quality of the sponge may seriously affect the smelting process and the quality of the steel.

The Foundry Apprentice.*

By C. Sherriff.

Sooner or later the Institute of British Foundrymen will have to deal fully with the subject of apprentices if the foundry is to keep progress with other branches of engineering. Every foundry manager is confronted with the problem of how to make the foundry attractive to the best boys, and also what to do with those who actually become apprentices. The author suggests that after a probationary period in the foundry, boys should be graded into one of three categories:—

Grade A.—Boys who are keen and interested and capable of general foundry work—moulding, core making, fettling and furnace work.

Grade B.—Boys who are capable and satisfied with doing moulding alone, and usually turn out quite satisfactory at such work.

Grade C.—The type of boy who, through misfortune and perhaps no fault of his own, is placed in the foundry, where he dislikes the dirt, smell and general conditions; usually this becomes his job for life.

Those who employ boys of the Grade C type should not hesitate to dismiss them, and thereby they may do the boy a useful service, as he may prove brilliant in another department. The Institute of British Foundrymen has a duty to perform to each of these boys, and some are neglecting that duty, not wilfully, but maybe carelessly. It is suggested that the Branches should form Junior Sections in each town, to be run by an executive and members interested in each town. They could allow the junior members to fix the date and time of meetings, select the speakers and get generally interested, and eventually give Papers themselves on foundry problems which directly affect them. It is thought this could be arranged and would turn out a very useful scheme for the Senior Branch. It would provide young men trained as junior foundrymen, ready for transferring when of age to the Senior Branch.

The author has long since arrived at the conclusion that foundry problems dealt with at the various Branch meetings are far too advanced for boys, and, sometimes, for the senior members too. It is useless dealing with boys and this problem when it is too late; it must be started immediately in real earnest, with the full realisation that any institution that does not cater for the younger generation is sure to fail sooner or later. The boys should be taught during working hours and not after spending a day in the foundry.

DISCUSSION.

Mr. C. Hallamore referred to the probationary period of the apprentice before placing the boy under one of the three grades mentioned by the author. How long should such a period be? It appeared that should the boy be graded in the lowest class, he would be dismissed, and if the probationary period extended over a long time the foundry would be taking a valuable period of the boy's time, which could be utilised in some trade more amenable to the boy. He supposed that the Grade A boys would be placed in a class to be trained as foundry foremen. If so, he would suggest the author was omitting from the training the most important sphere, the drawing office.

Mr. E. R. Walter mentioned the question of recruitment, and asked the author where he got his boys and what education, external to the foundry, he would suggest to run parallel with the foundry training.

Mr. Bunting suggested that the industry was suffering from an inferiority complex. It was commonly heard that the foundry apprentice was of lower intelligence than boys in other departments. That was not so. The work might not be so conducive as others. One of the big drawbacks was the lack of the best type of man to give the technical training. The man who has not had actual practical training would soon come "undone" when talking to boys engaged in actual foundry practice. The Institute should see the colleges have the best type of men for teachers. The grading mentioned was a difficult proposition, since at 17 a boy might not shape well, but at 21 he might be entirely different. If the grading started too soon, what would the position be? A tip-top moulder might not make a good foreman. The psychology of the individual had to be taken into consideration, otherwise there would be a waste of both boy's and teacher's time in training. For full-time training, he thought it should be for the man of 22 or 23 years of age. He was not greatly enamoured with part-time training in working hours. He thought that boys wanting to rise to executive positions should work for the position, and evening classes were an opportunity for the boy to display his eagerness to learn, by attending voluntarily. He would suggest that we concentrate more on the evening classes. At present there were very few technical colleges equipped for complete training.

Mr. Driver agreed with Mr. Bunting. He was an engineer, and when taking up his duties at the College he had a contempt for some of the things done in the colleges, and he had not lost that contempt. He thought it a mistake to try to teach foundry boys foundry work. They should teach the things allied to foundry work. It was a mistake to amplify the work the boy was doing in the day-time; he could learn a quantity of theoretical work. He thought the teachers should be in closer touch with the type of work the boys were doing in the daytime. He disagreed with the author's views on Junior Sections. They were all right so far as discussions were concerned, but he could not agree with juniors giving Papers. They did not know enough to write Papers. Far better to get skilled men to write simple Papers for the juniors to discuss.

Shop-Training Methods.

Mr. Lucas asked for members' opinions on the shop-training methods. Was it better to put a boy with a man, and later on small patterns on his own, or *vice versa?*

Mr. P. A. Russell agreed with the author, but he would suggest for Grade C boys that the foundry executive should not be too ready to place a boy in that class, but should persevere with the boy and give a little more personal attention until he could be placed in the higher grade. Regarding Junior Sections, he believed that the Lancashire Branch was the pioneer in that respect, and other districts were running them, with more or less success, where the Branch was concentrated in one area. He thought the widely-scattered area of the East Midlands did not lend itself to a successful Junior Section, and, apart from Derby, he did not think any of the other districts could attempt the course suggested by the author. He thought part daytime training could only be accomplished under a general educational scheme. His method was to start a boy with a man and then put him on small patterns under the supervision of the man. He did not think a boy should be left with a man above a year.

Mr. C. Bigg said the subject was a very wide one. He must take the view of the specialist. In covering the foundry, it was a tremendous sphere. What was the young man going to be? That could only be solved by experience. The man that turned out good castings might not be able to tell others how to do it. He could not imagine a foundryman being created in the technical college; he must have training in the shop, and then get the supplementary knowledge. We were increasingly becoming specialists, and we could not get away from it. Could we make a technical college responsible for creating foundrymen for all the different classes of foundry work in its area? The author had not mentioned the patternshop. Mr. Bigg felt that in the patternshop attached to the foundry there was, for the right man, a productive field. A man could learn there much for the executive positions.

* This Paper was awarded First Prize in the Short Paper Competition held by the East Midlands Branch of the Institute of British Foundrymen.

Heat-Resisting Paint and Rust Preventative.

The claims made for Kemick, a heat-resisting paint, manufactured by Nobel Chemical Finishes, Limited, of Slough, Bucks, were very graphically justified at the Birmingham section of the British Industries Fair, where the paint had been applied to furnace casings, furnace doors and even to oil burners. The conditions would, of course, be of the most exacting character, as furnace builders were out to demonstrate the capabilities of their furnaces, thus temperatures would be well up to commercial practice.

However, a careful inspection of the various parts treated, after the close of the Fair, showed the coatings to be in perfect condition. It was quite evident that it would not come off metal at red heat, and our representative was informed that its efficiency as a rust preventative is in no way lessened at such extreme temperature. These are conditions which render Kemick an ideal coating for such purposes as exhaust systems of internal-combustion engines, boilers, furnaces, stoves and the like, indeed under all conditions of heat which would completely decompose ordinary paint. The coating of Kemick is actually improved by the intermittent heating and cooling.

The paint has a liquid and volatile content which serves to spread it evenly on the surface and hold the pigment in place before heating. Under heat the paint decomposes, the volatiles are expelled in the form of fumes, and chemicals are liberated which react on the surface and become part of it and at the same time neutralise rust-production agents. Black when applied, the initial heating liberates a fine white powder, which, mixed with the black pigment, imparts a dark grey colour to the surface. It may be noted that the paint cannot be used, without protection, for exterior work, though such protection may consist of nothing more than a coat of suitable paint.

Iraq Pipe Line.

Orders for British Tube Manufacturers.

Messrs. Stewarts & Lloyds, Limited, have secured orders for a good proportion of the 1,200 miles of steel tubes required for the Iraq pipe line. The tubes are required by the Iraq Petroleum Company for its proposed pipe line across Iraq and Palestine to two ports on the Mediterranean. Messrs. Stewarts & Lloyds, Limited, have secured the contract for the supply of 60,000 tons of the tubes, valued at over £500,000. Other portions of the contract for the supply of tubes have been allocated to French and German makers. It will be recalled that two years ago Messrs. Stewarts & Lloyds participated in a regrouping and rationalisation of the tube industry, and there have been further developments since. It is believed that the rationalisation process has been of material assistance to the company in enabling it to compete with tube manufacturers abroad who tendered for this order.

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This Week's News in Brief.

Trade Talk.

Messrs. John Lewis & Son, Limited, Aberdeen, have secured an order for a 1,200-ton vessel for British owners.

The address of the Low Moor Iron Company, Limited, has been changed to Lincoln House, High Holborn, London, W.C.1.

Pittevil & Company, 46, Victoria Street, London, S.W.1, announce that they have now sold 31 "Sesci" furnaces since 1928, six of which have been placed in England.

Messrs. John Riddell & Company, 19, Waterloo Street, Glasgow, have been appointed the Scottish representatives for quarries, brickworks and the like of Messrs. Edgar Allen & Company, Limited, of Sheffield.

The London & North Eastern Railway Company has placed a contract with the Birmingham Railway Carriage & Wagon Company, Limited, Smethwick, for 220 steel containers, each of 4 tons carrying capacity.

The directors of the Southern Railway have authorised the construction at the company's works at Eastleigh, Ashford, and Lancing, of 10 passenger tender engines, 260 passenger coaches, 10 restaurant cars and 1,000 wagons.

Foundry Plant & Machinery, Limited, 110, Wellington Street, Glasgow, announce that they have recently received orders from the Ford Motor Company, Limited, for three sandslingers with batch mixers and feeder for use in the plant at Dagenham.

Messrs. Craven Brothers (Manchester), Limited, Vauxhall Works, Reddish, Stockport, have appointed the Coleman Foundry Equipment Company, Limited, 14, Southampton Street, London, W.C.2, as sole agents for Great Britain and the Irish Free State for the sale of their range of centrifugal casting machines.

Owing to the shifting of the channel in the Leven estuary, it has not been possible for pig-iron to be shipped from the ironworks pier at Ulverston for some years, but recently there has been a change in the channel, and last week-end a small coasting craft took away from Ulverston a cargo of 250 tons of pig-iron, the first despatch from Ulverston for 18 years.

On Thursday, March 31, at the conclusion of the ceremonies connected with the freeing of the Toll Bridge at Gainsborough, which connects Lincolnshire with Nottinghamshire, the Minister of Transport, Mr. P. J. Pybus, accompanied by Col. C. H. Bressey, of the Ministry of Transport, Lt.-Col. A. P. Heneage, M.P. for Louth, and Capt. H. F. C. Crookshank, M.P for Gainsborough, visited the Britannia Works of Messrs. Marshall, Sons & Company, Limited, Gainsborough, and made a tour of inspection.

The monthly journal of the Sheffield Chamber of Commerce states in the current issue that the demand for Sheffield special steel to make safety razors and their blades, for Sheffield-made safety razors, and above all for Sheffield safety razor blades, is phenomenal. From practically all parts of the world the volume of orders has developed into a flood, and the tide is still rising. Foreign competition has just about ceased in the home market. Exports have greatly increased and the increase seems to be progressive.

Contracts Open.

Belfast, April 21.—Iron and steel stores, for the Corporation. The Engineer and Manager, Gasworks, Ormeau Road.

Birkenhead, April 18.—Iron and steel stores, for the Corporation. Mr. F. E. Spencer, borough electrical engineer, Craven Street, Birkenhead.

Portugal, April 18.—Switches and crossings, for the Compagnie des Chemins de Fer Portugais. The Department of Overseas Trade. (Reference G.X. 11,331.)

Sunderland, April 25.—Three quay cranes, for the Sunderland Corporation. Mr. W. H. S. Tripp, c/o River Wear Commissioners, St. Thomas Street, Sunderland. (Fee £4, returnable.)

New Companies.

Forth & Clyde Steel Foundry, Limited.—Capital £5,000. Solicitors: Patrick & Paterson, 113, West Regent Street, Glasgow, C.

Heades Bros., Limited.—Capital £1,500. Iron founders. Directors: M. Heade, 32, Arran Quay, Dublin; E. Power, J. J. Hart and J. F. Lalor.

Walker Castings, Limited.—Capital £1,500. Directors: E. Walker, H. Wolstenholme, "Edensor," Bushey Wood Road, Totley, Sheffield; and A. Biagden.

Cochrane & Sons, Limited, Ouse Shipbuilding Yard, Selby, West Yorks. Capital £50,000. Shipbuilders. Directors: T. M., A. L., D. M. and S. J. Cochrane.

I.C.I. (Explosives), Limited, Imperial Chemical House, Millbank, London, S.W.1. — Capital, £4,992,900 in £1 shares, to acquire and hold not less than 90 per cent. in the case of shares, and the whole or part of the debentures, debenture stock and other interests in Nobel's Explosive Company, Limited; Curtis's & Harvey, Limited; Bickford Smith & Company, Limited; W. H. Wakefield & Company, Limited; Alexander Walker & Company, Limited; the Sedgwick Gunpowder Company, Limited; the Liverpool Magazines Company, Limited; British Westfalite, Limited; R. & T. Jack & Company, Limited; the Patent Electric Shot Firing Company, Limited; Roburite & Ammonal, Limited, and the Lancashire Explosives Company, Limited; and to carry on the business of manufacturers of and dealers in explosives and ammunition, etc. Directors and managers: Imperial Chemical Industries, Limited.

Company Reports.

Brown Bayley's Steelworks, Limited.—No interim dividend will be paid on the preference shares.

John Summers & Sons, Limited.—Dividend on the ordinary shares of 2½ per cent., leaving £181,676 to be carried forward.

Tharsis Sulphur & Copper Company, Limited.—Net profit, £62,577; brought in, £30,893; dividend of 5 per cent.; carried forward, £30,970.

A. Reyrolle & Company, Limited.—Profit, £106,547; brought in, £75,558; dividend of 12½ per cent. on the ordinary shares; transferred to reserve, £30,000; carried forward, 72,520.

British Thomson-Houston Company, Limited—Profit, £450,046; brought in, £215,698; interest on debentures and loans, £117,070; depreciation, £150,208; to general reserve, £20,000; dividend on the ordinary shares of 5 per cent.; carried forward, £221,265.

Obituary.

The death occurred on April 6, in his 69th year, of Mr. Thomas Walter Pollock, for many years manager of the Pointhouse Works of A. & J. Inglis, Limited.

Mr. John Thomas, formerly manager of Messrs. Colvilles' Dalzell Steel Works, died last week in Motherwell. He retired from active work less than a year ago.

Mr. William Hudson, of Elleraybank, Kirkintilloch, died suddenly on April 8 at the age of 58. Mr. Hudson succeeded his father as director and works manager of the Lion Foundry Company, Limited, Kirkintilloch, but retired just over a year ago for reasons of health.

Mr. John Raine, for many years connected with Messrs. Raine & Company, Limited, iron and steel manufacturers, Derwenthaugh, Durham, has died at the age of 83. A native of Witton Gilbert, Durham, Mr. Raine was the son of Mr. Nicholas Raine, manager of the Witton Park ironworks of Messrs. Bolckow, Vaughan & Company, with which firm he was connected for some time, occupying positions in Sunderland and Newcastle. He retired from the directorship of Messrs. Raine & Company several years ago. Mr. Raine was a Justice of the Peace for Gateshead.

Personal.

Sir Mark Webster Jenkinson and Sir A. George Hadcock have been elected directors of the English Steel Corporation, Limited.

Mr. E. Sayers has been appointed sales manager of the Coventry works of the British Thomson-Houston Company, Limited, succeeding the late Mr. E. Garton.

Mr. Dugald Baird, of Kaimahill, has received a presentation from his friends and colleagues on the occasion of his retirement from the position of manager of the Muirkirk works of Bairds & Dalmellington, Limited.

Mr. W. J. Cook, a native of Staffordshire, who went to America in 1867, last month celebrated his fiftieth anniversary as executive head of the galvanising departments of the Wheeling Steel Corporation, Wheeling, W. Va., U.S.A.

Mr. J. W Leach has been appointed manager of the British Thomson-Houston Company's London office, in succession to the late Mr. A. H. Walton. Mr. Leach entered the service of the B.T.H. Company at Rugby in 1904, and since 1920 assisted the late Mr. Walton as sales engineer on the London office staff.

Will.

Sir Archibald McInnes Shaw, chairman and principal partner of Shaw & McInnes, Glasgow £24,799

Patent Specifications Accepted.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

31,109. Vereinigte Stahlwerke Akt.-Ges. Corrosion-resistant steel. 365,538.

34,961. Higgins, Limited, H. R., and Forster, R. H. B. Furnaces for melting metals and the like. 365,704.

2,886. Williams, D. D., and Williams, Limited, H. Railway fishplates. 365,803.

1,428. Iljin, S. S. Regulating apparatus for hydraulic presses. 365,772.

4,166. Ameen, E., and Olsson, R. Hollow drill steels and the like. 365,822.

6,660. Fuery, G. T. (Schuler Akt.-Ges., L.). Press for drawing sheet metal. 365,851.

7,102. Jordan, F. Process for rolling out zinc plates in sheet or strip form, and the products obtained thereby. 365,856.

10,868. Krupp Akt.-Ges., F. Hard alloys. 365,895.

21,200. Elkington, H. D. (Ohio Sanitary Engineering Corporation). Method of purifying hot spent pickle liquors from steel mills and the like. 365,981.

32,376. Soc. des Brevets Berthelemy de Montby. Aluminium alloys. 366,088.

32,518. Brown & Tawse Tubes, Limited, and Slack, J. E. Pipe joints. 366,093.

33,261. Connollys' (Blackley), Limited, and Travis, W. Method and apparatus for the extrusion of metals and other materials. 366,154.

33,402. Vickers-Armstrongs, Limited. Box-forming machines. 366,155.

34,093. Lissauer, Dr. M., Lissauer, H., and Griesmann, B. (trading as Lissauer et Cie, M.). Process for separating non-ferrous metals from molten metalliferous materials. 366,168.

35,854. Costes, C. M. P. Sheet-piling units and assemblies composed thereof. 366,192.

35,898. Vereinigte Stahlwerke Akt.-Ges. Methods of increasing the resistance to corrosion of steel and cast iron. 366,193.

36,627. Broemel, L. E. Hot-rolling of thin metal bands, sheets, etc. 366,198.

45. British Driver-Harris Company, Limited, Carbonised nickel and method of manufacture. 366,236.

8,328. Krupp Akt.-Ges., F. Non-magnetic steels. 366,326.

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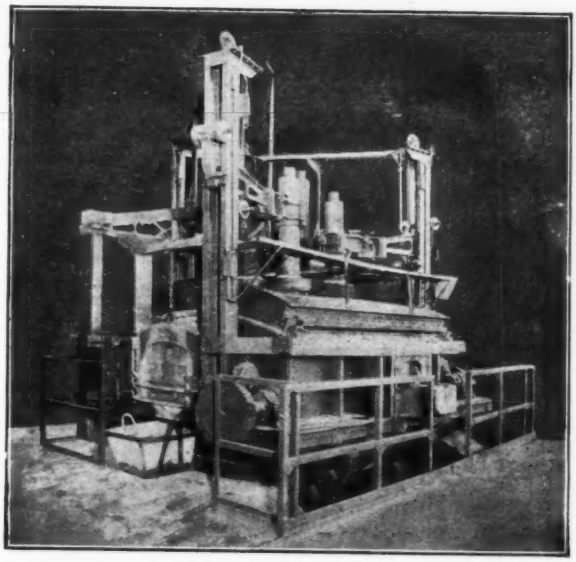
MORE THAN 100 FURNACES SUPPLIED DURING LAST 7 YEARS.

WATSON ROTATING ELECTRIC FURNACES Ensure RAPID & CLEAN MELTING

THOROUGH MIXING.



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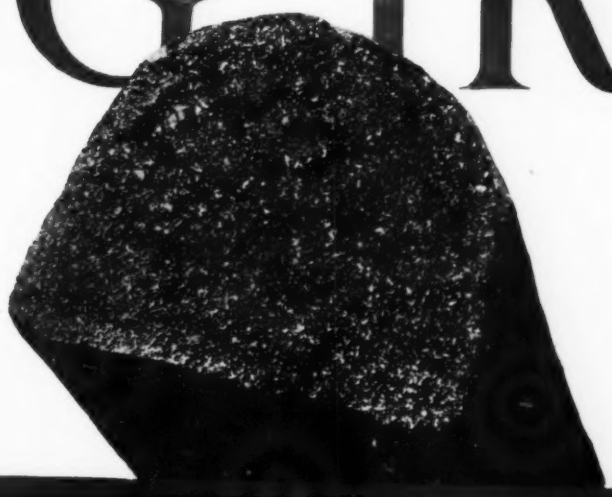

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DORMAN LONG & COMPANY LTD.,(Incorporating BOLCKOW VAUGHAN & Co., Ltd.,)MIDDLESBROUGH

DORMAN LONG

Raw Material Markets.

The iron and steel markets have shown slightly more activity during the past week, although not, it is to be feared, on the export side. More orders for forward delivery are being given out by home consumers. The demand for pig-iron remains steady, but importations of Indian iron continue on a large scale. The semis market remains dull, little business being taken by the Continental works, who continue to quote low prices. There is only a dull demand for tinplates and galvanised sheets.

Pig-Iron.

MIDDLESBROUGH.—Although market feeling is more hopeful, actual business has yet to show an increase. Only 17 furnaces are in blast in the Cleveland area, the producers being determined not to run the risk of increasing their stocks of unsold iron. Prices remain unaltered, as follow:—No. 1 Cleveland foundry iron, 61s.; No. 3 Cleveland G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; No. 4 forge, 57s. per ton, f.o.t.

There has been little improvement in the demand for East Coast hematite, but no more cheap offers of surplus iron are being made, and quotations are steady at 63s. 6d. per ton for mixed numbers and 64s. for No. 1 quality. Sales of West Coast hematite have shown some improvement during the past week, but both the Workington and Barrow steelworks are idle at the moment. Overseas orders have shown some increase.

LANCASHIRE.—New orders for foundry iron are scarce, only a few odd additional bookings being made. On the other hand, contract deliveries are maintained at a steady level, except, however, in connection with the textile-machinery industry. Prices remain at 67s. per ton for Derbyshire, Staffordshire and North-East Coast No. 3, 65s. 6d. for Northants, 62s. for Derbyshire forge, about 86s. for Scottish pig-iron, and 81s. for West Coast hematite, all for delivery in the Manchester district. Indian iron is freely offered at 77s., although as much as 2s. per ton less has been mentioned in some cases.

MIDLANDS.—The output of the furnaces in this area exceeds the deliveries, and additions are being made to makers' stocks. Quieter conditions prevail in the foundry trade, and there has been no improvement in the heavy engineering industries. Quotations remain unaltered, at 62s. 6d. per ton for No. 3 Northants, and 66s. for North Staffordshire, Derbyshire and Lincolnshire No. 3, including delivery to Birmingham and Black Country stations.

SCOTLAND.—The market remains dull, and only a few small sales for immediate delivery are reported. Imports of Cleveland pig-iron have shown an increase, partly owing to the decrease in Continental competition. Scottish No. 3 foundry remains at 69s. 6d. per ton f.o.t. furnaces, with 2s. 6d. per ton extra for No. 1. No. 3 Middlesbrough is at 58s. 6d. per ton f.o.t. Grangemouth, possibly less, and other English irons are at about 1s. per ton below this level.

Steel.

Slightly more activity has been witnessed in the finished-steel market, mainly in the structural section. The demand for shipbuilding material remains very poor. The mills find difficulty in carying on operations, the miscellaneous character of the orders received necessitating frequent changing of rolls. There is only a slack demand for semi-finished steel. Sellers of Continental material have cut their prices in an endeavour to attract business, but with little success.

Scrap.

A general slackness of buying is apparent in the Cleveland scrap iron and steel market. Sellers quote 40s. per ton for heavy cast iron, but this figure could be shaded. Heavy machinery quality finds few orders at 42s. 6d., while light castings are at 35s. per ton. In the Midlands market, new business is scarce. Merchants are also experiencing difficulty in getting delivery orders against contracts. Heavy machinery cast-iron scrap, broken into cupola sizes, is at 47s. 6d., heavy pipe and plate scrap at 42s. 6d. and clean light cast-iron scrap at 37s. 6d. to 40s., per ton delivered.

Coke.

The demand for coke has shown no improvement. Orders taken this week have mostly been for small tonnages, and there has been little forward contracting. Durham coke is offered delivered Birmingham at 35s. to 37s. 6d., according to analysis, and Welsh grades at from 30s. to 45s. per ton.

Metals.

Copper.—The price of standard copper has averaged about £29 10s. during the past week, a slight revival of buying in one or two quarters being offset by continued anxiety as to financial conditions in Europe. The Exporters' c.i.f. quotation has remained at 6¼ cents, but the Customs smelters have done a fair amount of business with English consumers at the reduced price of 6 cents c.i.f. The drastic curtailment measures already taken by the producers seem powerless to deal with the situation of the market in America, where, owing to the paucity of the demand, copper is being offered at less than 5¾ cents f.a.s. In view of the present situation, a total cessation of production is not altogether improbable.

Closing quotations :—

Cash.—Thursday, £29 10s. to £29 11s. 3d.; Friday, £29 3s. 9d. to £29 6s. 3d.; Monday, £29 8s. 9d. to £29 10s.; Tuesday, £29 5s. to £29 7s. 6d.; Wednesday, £29 7s. 6d. to £29 10s.

Three Months. — Thursday, £29 10s. to £29 11s. 3d.; Friday, £29 7s. 6d. to £29 10s.; Monday, £29 13s. 9d. to £29 15s.; Tuesday, £29 10s. to £29 12s. 6d.; Wednesday, £29 12s. 6d. to £29 15s.

Tin.—The standard market has steadily weakened, Tuesday witnessing a new low record for the year, at £102 5s., or about £80 in gold values. Little seems to have come of the recent meeting in Paris of the International Tin Committee, no official statement being published. More optimism is being expressed in the American market. Although industrial activity there has not increased, it is stated that, in recent months, consumers have not been taking as much tin as they could have done, relying to some extent on their stocks, which should soon need replenishing. Any recovery in the tinplate or motor industries should accelerate this development.

Official closing prices :—

Cash.—Thursday, £106 15s. to £107 5s.; Friday, £105 2s. 6d. to £105 5s.; Monday, £104 7s. 6d. to £104 10s.; Tuesday, £102 5s. to £102 10s.; Wednesday, £103 7s. 6d. to £103 12s. 6d.

Three Months.—Thursday, £109 5s. to £109 15s.; Friday, £107 12s. 6d. to £107 15s.; Monday, £106 12s. 6d. to £106 15s.; Tuesday, £104 10s. to £104 15s.; Wednesday, £105 10s. to £105 15s.

Spelter.—Steady conditions prevail in this market, order-books being sufficiently well filled to enable the producers not to press sales. The position, however, is likely to be adversely affected by the course of the other base metals, and it is impossible to take a long view of the situation.

Daily fluctuations :—

Ordinary.—Thursday, £10 11s. 3d.; Friday, £10 16s. 3d.; Monday, £10 17s. 6d.; Tuesday, £11; Wednesday, £11 2s. 6d.

Lead.—Although business in America and Europe has been dull, welcome interest has been shown over here by the pipe and sheet trade, which has made several large purchases. Largely owing to this, the London price of soft foreign has shown a steady improvement. The New York quotation has also been maintained at the reduced level of 3 cents per lb., in spite of a general lack of business.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £10 17s. 6d.; Friday, £10 18s. 9d.; Monday, £11; Tuesday, £11; Wednesday, £11.

Erratum.—A fairly obvious error appeared as a caption to Fig. 6 of Dr. Everest's Paper on "Cast Irons with Higher Nickel Additions" (p. 217, April 7 issue), and the words "right and left" should read "left and right."

Company Meeting.

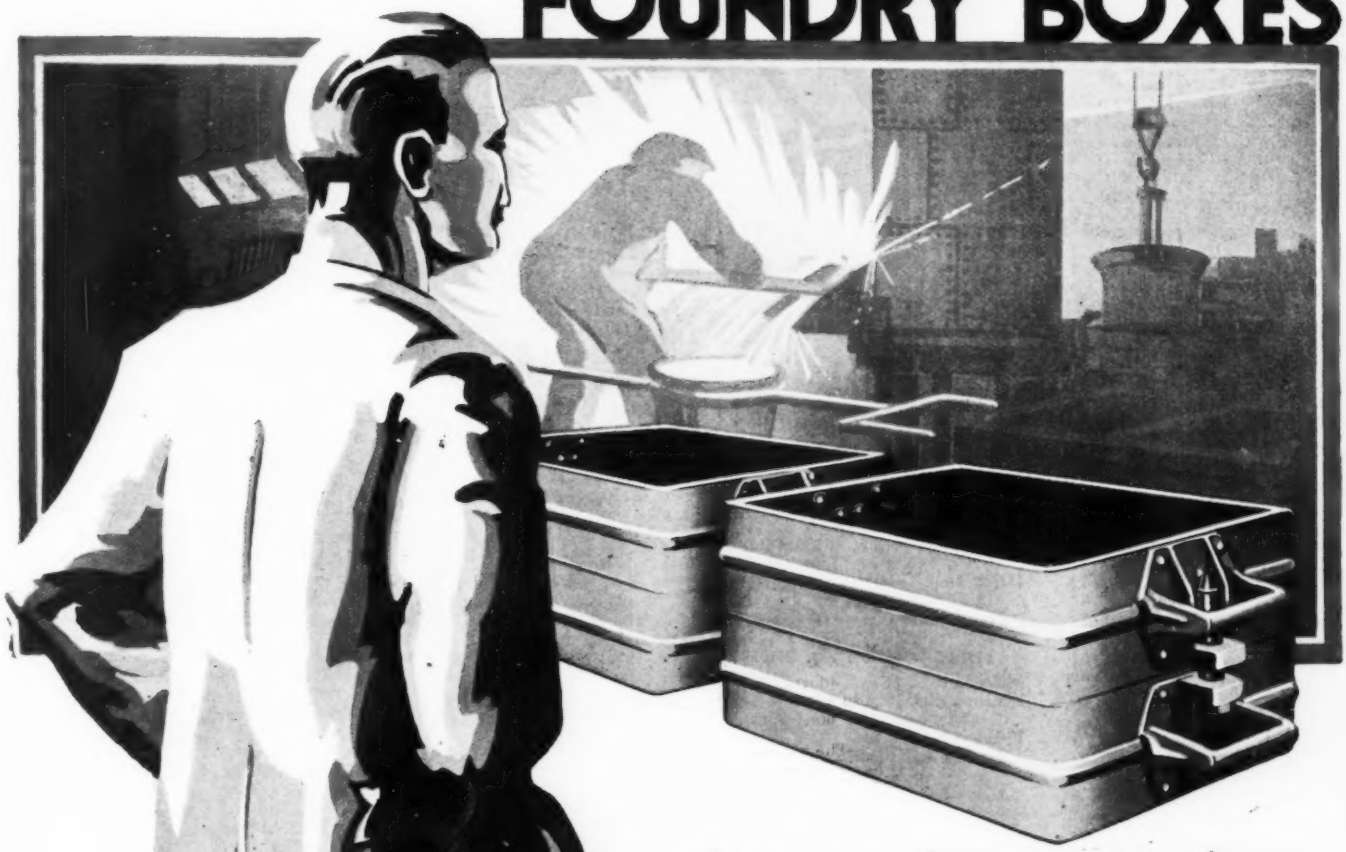
British Aluminium Company, Limited.

Presiding at the annual meeting of the British Aluminium Company, Limited, Mr. R. W. Cooper (the chairman) said that the trading profit was the lowest they had experienced for 10 years, but this was not to be wondered at considering the extremely difficult times and onerous conditions under which British industries had to be carried on in recent times, and more particularly during the past year. The markets of the world were largely closed to British producers by high and ever-increasing protection, whilst Britain retained free entry for any and every importer. This state of affairs was greatly accentuated last year by the serious shrinkage in consumption of all commodities in this country and throughout the world. It was not to be expected that aluminium would be an exception, and consequently, as was anticipated, the demand for the metal declined progressively during the year. In semi-manufactured products the competition referred to last year was still further intensified, with a corresponding diminution in the profits derivable from this source, which constituted a very important side of the company's activities. Some alleviation of their difficulties was obtained following the departure of this country from the gold standard in September last, when it became possible to raise sterling prices to a limited extent. Against this relief they had to set a considerable increase in costs of production due to the charge entailed by the necessary purchase of certain raw materials on a gold basis. The recent duty of 10 per cent. on most imports, including aluminium, should, on balance, be of some small benefit to the industry, but that duty was still much inferior to the permanent protection enjoyed by the large producers of the metal in their own territories in other parts of the world. As a consequence of adverse tariffs their exports continued to contract, and they had small opportunity of reaping the advantage which might otherwise accrue to them from the existing exchange situation. The reduction in demand had not only necessitated continuance of the curtailment of production which he recorded last year, but had also enforced a considerable extension of that policy. Stocks of metal in the hands of all the producers were mounting to a tonnage which in the aggregate could only result in being, in the course of time, a potential danger to the industry. It was common knowledge what happened in the case of other non-ferrous metals, which were still suffering from over-production and unwieldy stocks, coupled with greatly reduced consumption. Happily this situation had been mitigated in the case of aluminium by reason of the control of excessive stocks and limitation of production. This stabilisation had been achieved by the formation of a company under the name of the Alliance Aluminium Company, in which they held a considerable proportion of the share capital, in association with the large European and Canadian producers, and which maintained a judicious balance amongst its shareholders as between production, consumption, and stocks. The safeguard thus provided was calculated to preserve the industry from the violent fluctuations which would undoubtedly otherwise occur, and this was greatly to the benefit of the consumer as well as the producer.

The Institute of Metals.—The twenty-second Annual May Lecture of the Institute of Metals will be delivered by Prof. Dr. F. Körber (director, Kaiser Wilhelm-Institut für Eisenforschung, Düsseldorf), on Wednesday, May 11, at 8 p.m., at the Institution of Mechanical Engineers, Storey's Gate, Westminster, London, S.W.1, the subject of the lecture being "The Plastic Deformation of Metals." Cards of invitation to the lecture may be obtained from Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W.1.

Nickel Steel Plates.—The increasing use of alloy steels in general engineering is an interesting sign of the desire to take advantage of the higher stresses for which these materials are useful, whilst at the same time reducing weight. Keeping pace with this trend, the Appleby (Lincs) works of the United Steel Companies, Limited, which has previously manufactured only mild and medium carbon steels for boiler, ship, bridge, tank and similar structural purposes, is now manufacturing nickel steel plates in all sizes from ⅛-in. thick upwards. Nickel steel plates are now in much use for automobile and heavy vehicle chassis frames, brake drum pressings, as well as for structural engineering purposes, bridge and railway work.

FOUNDRY BOXES



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Agents at GLASGOW and MANCHESTER

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	29	7	6
Three months	29	12	6
Electrolytic	34	0	0
Tough	32	5	0
Best selected	32	10	0
Sheets	63	0	0
India	43	10	0
Wire bars	35	10	0
Do., May	35	0	0
Do., June	34	10	0
Ingot bars	35	10	0
H.C. wire rods	38	10	0
Off. av. cash, Mar.	33	1	9 1/3
Do., 3 mths., Mar.	33	6	2½
Do., Sttlmnt., Mar.	33	1	10½
Do., Electro, Mar.	37	5	1½
Do., B.S., Mar.	36	10	3½
Do., wire bars, Mar.	37	14	6½
Solid drawn tubes			10d.
Brazed tubes			10d.
Wire			6¾d.

BRASS.

Solid drawn tubes	9¼d.
Brazed tubes	11½d.
Rods, drawn	8½d.
Rods, extd. or rlld.	4¾d.
Sheets to 10 w.g.	7¾d.
Wire	7½d.
Rolled metal	7d.
Yellow metal rods	4¾d.
Do. 4 × 4 Squares	5¾d.
Do. 4 × 3 Sheets	5¾d.

TIN.

	£	s.	d.
Standard cash	103	7	6
Three months	105	10	0
English	105	5	0
Bars	105	15	0
Straits	106	5	0
Australian	103	15	0
Eastern	109	0	0
Banca (nom.)	111	5	0
Off. av. cash, Mar.	129	18	2½
Do., 3 mths., Mar.	131	12	6½
Do., Sttlmt., Mar.	129	17	10½

SPELTER.

	£	s.	d.
Ordinary	11	2	6
Remelted	10	0	0
Hard	9	10	0
Electro 99.9	13	5	0
English	11	15	0
India	11	0	0
Zinc dust	22	0	0
Zinc ashes	2	5	0
Off. aver., Mar.	12	16	4½
Aver. spot, Mar.	12	12	3½

LEAD.

	£	s.	d.
Soft foreign ppt.	11	0	0
English	13	0	0
Off. average, Mar.	12	9	9½
Average spot, Mar.	12	6	10½

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	0	0
Do., V.M. ex-whf.	20	5	0
Rods	27	0	0
Boiler plates			—
Battery plates			—

ANTIMONY.

	£	s.	d.
Special brand Eng.	40	0	0
Chinese	26	0	0
Crude	18	10	0

QUICKSILVER.

	£	s.	d.
Quicksilver	16	17	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£5 17 6
45/50%	£12 10 0
75%	£17 15 0
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free, 4/2, plus 55%, per lb. of Mo.	
Ferro-titanium—	
23/25% carbon-free	11¼d. lb.
Ferro-phosphorus, 20/25%	£20 2 6
Ferro-tungsten—	
80/85%	1/8½ lb. plus 20%
Tungsten metal powder—	
98/99%	1/11½ lb. plus 20%
Ferro-chrome—	
2/4% car.	£28 17 6
4/6% car.	£25 12 6
6/8% car.	£24 0 0
8/10% car.	£23 15 0
Ferro-chrome—	
Max. 2% car.	£37 15 0
Max. 1% car.	£43 12 6
Max. 0.70% car.	£52 0 0
70% carbon-free	1/- lb.
Nickel—80/99.5%	£220 to £225
"F" nickel shot	£212 10 0
Ferro-cobalt	8/6 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	2/9 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export (nom.)	£9 0 0
Metallic manganese—	
94/96% carbon-free	1/5 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 3/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ¼ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel	2	2	6	to	2	5	0
Bundled steel and shrngs.	1	16	0	to	1	17	6
Mixed iron and steel	1	18	0	to	2	0	0
Heavy cast iron					2	5	0
Good machinery for foundries	2	7	6	to	2	10	0
Cleveland—							
Heavy steel					1	15	0
Steel turnings					1	12	6
Cast-iron borings					1	6	0
Heavy forge					2	15	0
W.I. piling scrap					2	7	6
Cast-iron scrap	2	0	0	to	2	2	6
Midlands—							
Light cast-iron scrap					1	17	6
Heavy wrought iron					2	12	6
Steel turnings, f.o.r.					1	1	6
Scotland—							
Heavy steel					1	17	6
Ordinary cast iron					2	6	0
Engineers' turnings					1	10	0
Cast-iron borings					1	11	0
Wrought-iron piling					2	5	0
Heavy machinery					2	11	6

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	26	0	0
Brass	19	0	0
Lead (less usual draft)	9	0	0
Tea lead	6	0	0
Zinc	5	0	0
New aluminium cuttings	72	0	0
Braziery copper	23	0	0
Gunmetal	21	0	0
Hollow pewter	70	0	0
Shaped black pewter	50	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	64/-
Hematite M/Nos.	63/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
d/d Birm.	84/6
Malleable iron d/d Birm.	117/6
Midlands—	
Staffs common*	—
No. 4 forge*	61/-
No. 3 fdry.*	66/-
Shrops basic	—
Cold blast, ord.	—
roll iron	—
Northants forge*	57/6
fdry. No. 3*	62/6
fdry. No. 1*	65/6
Derbyshire forge*	61/-
fdry. No. 3*	66/-
fdry. No. 1*	69/-
basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	72/-
No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
fdry. No. 3	63/6
Lincs forge	—
fdry. No. 3	63/6
E.C. hematite	75/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	86/-
Clyde, No. 3	86/-
Monkland, No. 3	86/-
Summerlee, No. 3	86/-
Eglinton, No. 3	86/-
Gartsherrie, No. 3	86/-
Shotts, No. 3	86/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

	£	s.	d.		£	s.	d.
Iron—							
Bars (cr.)	9	15	0	to	10	0	0
Nut and bolt iron					8	7	6
Hoops	10	10	0	to	12	0	0
Marked bars (Staffs) f.o.t.					12	0	0
Gas strip	10	10	0	to	12	0	0
Bolts and nuts, ¾ in. × 4 in.					12	2	6
Steel—							
Plates, ship, etc.	8	15	0	to	8	17	6
Boiler plts.	8	10	0	to	9	5	0
Chequer plts.					10	7	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)			6	12	6	& up.	
Flats—8 in. wide and over					8	12	6
under 8 in. and over 5 in.					8	17	6
Rails, heavy	8	5	0	to	8	10	0
Fishplates					12	0	0
Hoops (Staffs)					9	10	0
Black sheets, 24g.	8	0	0	to	8	10	0
Galv. cor. shts.	9	10	0	to	10	0	0
Galv. flat shts.	10	0	0	to	11	0	0
Galv. fencing wire, 8g. plain					12	10	0
Billets, soft	5	5	0	to	5	10	0
Billets, hard					6	12	6
Sheet bars	4	15	0	to	5	5	0
Tin bars					4	15	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	10¾d.
Sheet to 10 w.g.	11¼d.
Wire	12d.
Rods	11¼d.
Tubes	16½d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	15.59
No. 2 foundry, Valley	15.00
No. 2 foundry, Birm.	11.00
Basic	16.39
Bessemer	17.39
Malleable	17.39
Grey forge	16.89
Ferro-mang. 80%, seaboard	75.00
O.-h. rails, h'y, at mill	43.00
Billets	27.00
Sheet bars	26.00
Wire rods	37.00
	Cents.
Iron bars, Phila.	2.11
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.50
Skelp, sheared steel	1.50
Steel hoops	1.65
Sheets, black, No. 24	2.20
Sheets, galv., No. 24	2.85
Wire nails	1.95
Plain wire	2.20
Barbed wire, galv.	2.60
Tinplates, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	22/6 to 27/6
furnace	17/- to 18/-
Durham and Northumberland—	
foundry	14/6 to 15/-
furnace	13/- to 13/6
Midlands, foundry	—
furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	16/-
28×20 "	32/-
20×10 "	23/-
18¾×14 "	16/7½
C.W. 20×14 "	14/-
28×20 "	30/-
20×10 "	19/10
18¾×14 "	15/-

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 0 0
Bars, hammered, basis	£16 10 0 to £17 0 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 5 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Apr.	7 ..	29	10	0	dec. 12/6
,,	8 ..	29	3	9	,, 6/3
,,	11 ..	29	8	9	inc. 5/–
,,	12 ..	29	5	0	dec. 3/9
,,	13 ..	29	7	6	inc. 2/6

Electrolytic Copper.

		£	s.	d.	
Apr.	7 ..	34	0	0	dec. 10/–
,,	8 ..	34	0	0	No change
,,	11 ..	34	0	0	,, ,,
,,	12 ..	34	0	0	,, ,,
,,	13 ..	34	0	0	,, ,,

Standard Tin (cash).

		£	s.	d.	
Apr.	7 ..	106	15	0	dec. 35/–
,,	8 ..	105	2	6	,, 32/6
,,	11 ..	104	7	6	,, 15/–
,,	12 ..	102	5	0	,, 42/6
,,	13 ..	103	7	6	inc. 22/6

Tin (English ingots).

		£	s.	d.	
Apr.	7 ..	108	5	0	dec. 30/–
,,	8 ..	106	10	0	,, 35/–
,,	11 ..	105	15	0	,, 15/–
,,	12 ..	103	15	0	,, 40/–
,,	13 ..	105	5	0	inc. 30/–

Spelter (ordinary).

		£	s.	d.	
Apr.	7 ..	10	11	3	No change
,,	8 ..	10	16	3	inc. 5/–
,,	11 ..	10	17	6	,, 1/3
,,	12 ..	11	0	0	,, 2/6
,,	13 ..	11	2	6	,, 2/6

Spelter (Electro, 99.9 per cent.).

		£	s.	d.	
Apr.	7 ..	13	2	6	No change
,,	8 ..	13	2	6	,, ,,
,,	11 ..	13	2	6	,, ,,
,,	12 ..	13	5	0	inc. 2/6
,,	13 ..	13	5	0	No change

Zinc Sheets (English).

		£	s.	d.	
Apr.	7 ..	23	0	0	No change
,,	8 ..	23	0	0	,, ,,
,,	11 ..	23	0	0	,, ,,
,,	12 ..	23	0	0	,, ,,
,,	13 ..	23	0	0	,, ,,

Lead (English).

		£	s.	d.	
Apr.	7 ..	13	0	0	No change
,,	8 ..	13	0	0	,, ,,
,,	11 ..	13	0	0	,, ,,
,,	12 ..	13	0	0	,, ,,
,,	13 ..	13	0	0	,, ,,

Imports and Exports of Iron and Steel Castings in March and the three months 1932, compared with March and the three months 1931.

	March, 1931.	March, 1932.	Three months, 1931.	Three months, 1932.	March, 1931.	March, 1932.	Three months, 1931.	Three months, 1932.
Imports.	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Pipes and Fittings, Cast	1,059	428	3,132	1,196	13,672	9,482	39,419	20,684
Castings, in the Rough, Iron	156	117	538	294	3,045	2,776	10,560	6,206
,, ,, ,, Steel	515	58	1,746	746	11,177	1,626	38,928	15,229
Hollow-ware, Cast, not Enamelled	1	1	16	2	116	104	1,139	180
,, ,, Enamelled	6	22	33	25	346	608	1.398	931
Exports.								
BUILDERS' CASTINGS—								
To Argentine Republic	99	54	289	127	4,213	1,843	12,909	5,190
,, Irish Free State	370	326	1,013	1,066	17,858	14,325	49,069	46,240
,, British South Africa	142	116	405	417	5,776	4,916	16,704	15,604
,, ,, India	163	83	392	250	5,309	3,013	13,177	8,857
,, New Zealand	56	17	144	58	4,306	1,469	9,318	3,868
Total (including other countries)	1,186	971	3,337	3,024	53,255	40,400	153,574	126,676
PIPES AND FITTINGS—CAST—								
To Argentine Republic	802	345	2,069	742	7,794	3,835	19,838	7,952
,, Irish Free State	625	382	2,036	1,739	7,997	6,706	25,123	24,968
,, British South Africa	751	334	2,862	1,727	8,228	4,949	33,797	21,123
,, ,, India	143	120	422	334	2,801	1,715	8,588	5,066
,, Straits Settlements and Malay States	199	38	551	914	2,484	613	6,819	8,599
Total (including other countries)	5,275	4,823	18,457	17,097	63,669	53,268	213,422	177,790
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	204	238	658	579	7,216	7,065	21,791	20,006
,, Enamelled	33	94	151	184	3,903	6,474	15,313	14,520
CASTINGS, in the rough—								
Iron	80	56	407	211	2,617	2,461	15,182	8,662
Steel	256	62	487	256	6,753	2,367	16,529	9,540

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

ROLL Foundry MANAGER and METALLURGIST, with over 20 years' experience in technical and administrative control of large foundries, desires change. Successful production of chilled rolls, for hot and cold rolling, alloy C.I. rolls, and high-grade castings, from cupola and air furnace. Would act as consultant.—Box 146, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

YOUNG Foundry FOREMAN desires change to improve position; age 29; iron, bronze, aluminium; first-class references.—Box 142, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY FOREMAN wanted for abroad, capable of operating Tropenas Plant. Experience in iron and non-ferrous casting an advantage. Age 24/30; unmarried. Five years' agreement. Salary £35 per month.—Box 150, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of The Foundry Trade Journal.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

EXPERIENCED and well-known Foundry Manager is open to consider new engagement. Has had complete control of large foundries engaged in all branches of ironfoundry work, from small repetition work to castings of 50 tons. (168)

FOUNDRY Manager seeks re-engagement; 25 years' first-class experience on highest-class iron and brass castings, including pumps, cranes, and repetition work. Good technical knowledge. Age 49. (169)

IRON MOULDER desires position as Assistant Foundry Foreman; technical knowledge all branches iron and non-ferrous work; moderate salary accepted. Practical First Aid man. (170)

POSITION required as Foreman or Assistant to Manager by young Foundryman with exceptional practical experience in all classes of iron and non-ferrous foundry-work. Has held positions as foreman. Technically trained. Excellent references. (171)

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AGENCY.

WANTED, a Midland Agent to represent foundry (grey iron) making small repetition work. Excellent opportunity for man holding other agencies.—Box 148, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

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PUBLICATION.

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. 1932 edition. Now ready. Price 42s., bound in cloth.—Industrial Newspapers, Ltd., 49, Wellington Street, Strand, London, W.C.2.

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PROTECT YOUR IDEAS.—Free, "Advice Handbook" on patenting inventions and registering trade marks by Registered Agent with 45 years' experience.—Kings Patent Agency, Limited, 146a, Queen Victoria Street, E.C.4.

PATENTS relating to improved processes for manufacturing GREY CAST IRON.—The proprietors of BRITISH PATENTS Nos. 247941, 260619, 260990, 262043, 275646, 291112 and 341436 wish to sell the patents or to license British Manufacturers to work thereunder.—Address, A. Boshart, Stuttgart-Cannstatt, Ludwigstr. 42 (Germany).

MACHINERY.

NEARLY new Sandblast Room Plant; 8-ft. sq. room, V2 separator and cyclone, vertical compressor, fan and usual equipment; installed 1931, very little used; can be seen working.—Box 140, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

WHEEL Moulding Machines. One each 4 ft. 6 in., 5 ft. 0 in. and 6 ft. 0 in. Machines, new, to be sold at much-reduced prices.—Write for particulars, Buckley & Taylor, Limited, Oldham.

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12-Ton "Stevenson"	... ...	£48
9-Ton "MacNeil"	... ...	£42
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4-Ton "Evans"	... ...	£28
2-Ton "Evans"	... ...	£19

PNEUMATIC SQUEEZERS

14"×16" Mumford split pattern 2 @ £35
16" × 16" "Coventry" jolt squeezers ... ... 2 @ £35
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PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun, and on occasions—be it admitted—of naughtiness. Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception. Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed. There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

The Chairman.

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